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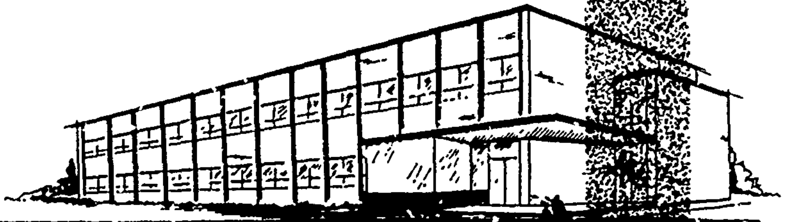

THE Bendix CORPORATION

BENDIX SYSTEMS DIVISION • ANN ARBOR, MICHIGAN

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VOLUME III SIMULATION STUDIES

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STROBE TRIANGULATION FORTRAN PROGRAM

The strobe triangulation simulator is programmed in three sections. Section 1 provides simulation of the target signals as they would appear to any azimuth-scan radar. Section 2 simulates the triangulation processes, and Section 3 prcvides data reduction on the output of Section 2.

This portion of the report presents the input/output format, glossary of terms, FORTRAN listing, and flow charts by Program Section

1.1 SECTION I - ENVIRONMENT PROGRAM

1.1.1 Input/Output

Input parameters necessary for each computer run are ıisted and described below:

NDS — Number of data sets where a data set consists of all the parameters which fol'ow. NDS is an integer and is punched in Columns 1 through 5.

IM1 — Intermediate Output One. If IM1 is zero, run, clock, unsorted azimuths, associated range functions and radar number will be printed out. If IM1 is one, the output just described is bypassed.

IM2 — Intermediate Output Two. The output data is the same as for IM1 except the azimuths have been sorted in ascending order. Output control is also the same.

IM3 — Intermediate Output Three. This output provides data regarding detection criterion. NOL (see Glossary of Terms), T (I), S, AI (I), BI(I), SUMJ, SUMK, SNR, SR (K), PD (K), RN, ST (L), K and L are printed out, if IM3 = 0, and bypassed, if IM3 = 1.

IM4 Intermediate Output Four. The output consists of a table of detected azimuths, if IM4 = 0, and the output is bypassed, if IM4 = 1.

ID Run number, an integer from one to one thousand.

NO Number of targets, an integer from one to one hundred.

NR Number of radars, an integer from one to five.

IFL Number of flight legs. Flight legs are counted as follows: Assume a flight of four targets identified as numbers one through four. Assume that the four fly parallel courses initially. Suppose that at frame 10 (clock 10) target one starts a diversionary maneuver but targets two, three and four continue on their original courses. Suppose at frame 25, targets three and four break off from their original course and each assume new courses which are not parallel. For this example IFL = 3. Thus flight legs are counted on a group basis. Even though targets three and four took up new courses at clock 25 this maneuver counts as only one flight leg as far as determining IFL is concerned. IFL is an integer from one to two hundred.

MAXLIM Maximum number of frames in any one run. MAXLIM is an integer from one to one hundred.

SCALE Scale factor for the off-line display. The scale factor is in nautical miles.

RFL Range function limit. RFL is computed as follows:

$$RFL = \frac{1}{1.44h}$$

where h is the altitude in feet of the attacking targets.

AG Antenna gain.

X (I) Initial x coordinate (frame 0) of target I, in nautical miles.

Y (I) Initial y coordinate (frame) of target I, in nautical miles. Note: Only the x, y coordinates of one target are placed on a card. Furthermore, the targets will be identified by number starting with one in the order in which the cards are read.

RX (I) X coordinate of radar I, in nautical miles.

RY (I) Y coordinate of radar I, in nautical miles. Radars are also identified by number starting with one in the order in which the radar cards (one radar coordinate set per card) are read.

PD (I) Probability of detection.

SR (I) Signal Ratio.

ET Error term in radians. This is the "peak to peak" range throughout which a true azimuth may be jittered to simulate random azimuth error.

S One half of the passive main beam width, in radians.

Q Main beam width, in radians, ET, S and Q are read in from one card.

A Number of sequential frames for which computations are to be done. If A is negative then B frames are skipped before A frames are computed. A is an integer.

B — Number of frames that are to be skipped.

LIMIT — Frame number at which a new flight leg occurs, or at which it is desirable to change A and/or B. LIMIT is an integer from one to one hundred. A, B and LIMIT are read from one card.

DX (I) — X increment for target I motion each frame in nautical miles.

DY (I) — Y increment for target I motion each frame, in nautical miles. DX (I) and DY (I) for target I are read from one card. Note: The card order is very important since the increments are ordered numerically as read in starting with one. Thus, for example, the increment card for target 3 must be the third increment card so that it will be associated properly.

There are three general types of output; these are intermediate data, display data, and environment data.

1. 1. 1. 1 Intermediate Data

Intermediate data is primarily for check-out purposes and is put on Tape Unit 6 for tabulating. There are four sets of intermediate data each associated with an IM variable which is an input parameter. Run, clock, unsorted azimuths, range functions and radar number are associated with IM1. If IM1 is zero, output is obtained; if IM1 is a non-zero integer from one to 9999, no IM1 output is obtained.

IM2 output is comprised of the same variables as IM1 except that the azimuths have been ordered. The column titles are not printed as they are in IM1, but IM2 output is identified with the title "SORTED AZIMUTHS". The control for IM2 output is the same as for IM1 output and other IM outputs, which will be described in the paragraphs to follow.

IM3 Output provides information about strobe detection. The following variables comprise IM3: NOL, T(I), AI(I) (trailing edge of main beam), BI(I) (leading edge of main beam), SUM J, SUM K, SNR, SR(K), PD(K), RN, ST(L), K and L.

There are several idiosyncrasies about IM3 output which shouid be explained in order to avoid confusion in interpreting the data. First of all, note that AI(I), BI(I), SNR, and RN are never cleared; they are simply replaced as the occasion demands. Thus, whenever T(I) is negative (either -1. or -2.) AI(I), BI(I), SNR and RN are not computed so that whatever vaiues are stored in AI(I), BI(I), SNR and RN remain there and are outputed with the associated value of negative T(I). Therefore, disregard the values of AI(I), BI(I), SNR and RN whenever T(I) is negative. Second, even though SUM J and SUM K are cleared, this clearing is done just before a new SUM J and SUM K are to be computed. Thus, when T(I) is negative SUM J and SUM K are not cleared and the latent values will be outputed. Therefore, disregard the values of SUM J and SUM K whenever T(I) is negative. Third, if SUM K is 0. the computation of SNR is bypassed so that latent value will be printed as well as that of RN. Fourth, the variables PD and SR are indexed by K and ST by L. L is not incremented unless an azimuth (strobe) is detected so the latent value of ST(L) will be printed. Therefore ST(L) is valid only when L changes and is not zero. K is incremented only for finite SNR. Thus the values of PD(K) and SR(K) are valid only when K= 1, 2, 3 or 4.

IM4 Output is a list of detected strobes. Since the ST(L) table is placed into the first L positions in the T(I) table after the detection process is complete and since detected strobes are printed out in groups of four only the first L entries in the 4n of the printed table will be valid (n is the number of lines in the table). For example, suppose there nine targets and only seven strobes detected. Then two lines would be printed but only the first seven entries would be valid. The eight azimuth would be an undetected strobe or possibly a detected one which had been "moved up". That is, perhaps strobes 1, 2, 3, 5, 6, 7 and 8 were detected, then strobes 1, 2, 3, 5 would be printed in the first line and 6, 7, 8, 8 in the second line.

1.1.1.2 Display Data

Three types of output are provided for display purposes. These are radar positions for each run (type 16) true target positions for each frame (type 11) and azimuth in degrees and the direction points SINM COSM for each detected strobe for each radar for each frame (type 12). All display data is put on Tape Unit 5 and decimal cards are punched from the tape.

1. 1. 1. 3 Environment Data

There are eight types of environment data all of which are put on Tape Unit 4. Control output (no type number) occurs only once per run and consists of the run number, number of targets, number of radars and maximum limit of the clock. No titles are used. Radar position output (type 16) is identical in every respect to that used for display purposes. Similarily for true target position output (type 11). Index output (type 14) occurs once per radar per frame if the given radar detected strobes. The index is a count of the number of strobes detected by that radar. Sector data output occurs once per radar per frame if the given radar detected any strobes. Sector data consists of the number of targets in a sector and the leading and trailing edges of the sector. Run length and index output (type 17) in redundant in that it combines type 13 and 14 in slightly different form. Azimuth output (type 18) is a list of the center azimuth for each strobe for a given radar for a given frame. NRD output (type 19) has the same format as index output but the index is replaced with a count of the number of radars which have made at least one strobe detection in that frame.

1. 1. 2 Glossary

A — Number of frames to be computed. (If A is negative then B frames are skipped before A are computed.)

AG — Antenna gain expressed as a dimensionless ratio.

AI (I) — Trailing edge of main beam when main beam is centered on T (I).

ALPHA (I) or ALPHA J — Azimuth of the leading edge of a target where I or J is the running index on the variable.

B — Number of frames to be skipped.

BETA (I) or BETA (J) Azimuth of the trailing edge of a target where I or J is the running index on the variable.

BI (I) Leading edge of main beam when main beam is centered on T (I).

C (I) W (I) converted to degrees for use with off-line Bendix display facility.

CES (I) A variable generated for use by the off-line Bendix display facility. The variable is indexed by I. See FORTRAN statement following number 122 for a definition of CES (I).

CLK Title for the frame number.

DX (I) X increment by which target I is to be moved each frame where I is the running index on the variable.

DY (I) Y increment by which target I is to be moved each frame where I is the running index on the variable.

ET Error term. This is the total width in radians of the azimuth interval throughout which the observed azimuth may fall. The error term azimuth interval is centered about the true azimuth.

I Index

IC, IE Indices used for azimuths and corresponding range functions in the azimuth sorting routine IE is also set equal to the number of sectors less one and used as the maximum index value in a do loop.

ID Run number.

IFL Number of flight legs.

IG Temporary storage for a particular value of I, an index in the merging routine.

IJ	Index equal to I plus one. IJ is used in the merging routine.
IMI, IM2, etc.	Intermediate Output 1, Intermediate Output 2, etc. If IM1 = 0, then the output identified with IM1 will be printed on Tape Unit 6. If IM1 = 1 then the output identified with IM1 will be bypassed. The primary purpose is to provide output for checkout purposes.
J	Index
JLB	Variable of an assigned "GO.TO" statement.
K (I) or K (J)	Number of targets in a sector.
KING	Variable of an assigned "GO TO" statement.
KLOCK	Frame number.
KPLB	Klock plus LB.
KTS	Variable of an assigned "GO TO" statement.
L	Count of number of detections before merging.
LA	Integer variable corresponding to the floating variable A.
LAP	LA or some decremented value of LA.
LB	Integer variable corresponding to the floating variable B.
LIMIT	Either the number of a frame where a new flight leg is to be followed or the maximum number of frames in a given run.
MAR	Variable for output data type code. It takes the value 16 and indicates radar position output.
MARG	A fixed point variable for identification.

MAXLIM — Maximum number of frames in a given run.

MT — Variable for output data type code. The only value MT assumes is 18 which is the numerical type designation for azimuth output.

MX — Variable for output data type code. The values and their significance are listed below:

MX = 11 Target output
= 12 T (I) in degrees and direction point output for off-line Bendix display
= 13 Sector leading and trailing edge and number of targets in sector output
= 14 Radar number and index output
= 17 Azimuth run length and number of targets in sector output
= 19 Number of radars making detections in given frame

MY — Variable for type of target output. If MY = 6 the target output is true targets. Since only true targets are produced by Section I, MY will assume no other value in Section I.

NDS — The number of data sets (runs) plus one. For example, suppose it is desired to make runs 4, 5 and 6 at one time. Then NDS = 4. If run 7 only is to be made, then NDS = 2.

NIL — Nil - nothing.

NO — Number of targets.

NOL — A variable generated in the detection routine and used as the starting index on the SUMJ and SUMK do loop within the detection routine.

NR — Number of radars in a given run.

NRD Number of radars making detections in a given frame.

NX Variable of an assigned "go to" statement.

PD (I) or PD(K) Probability of detection where I or K is the running index on the variable.

PI π to eight decimal places.

Q Beamwidth in radians.

RF (I) Range function. The range function is defined as the reciprocal of the square of the range of target I from radar IR.

RFL Range function limit.

RN A random number generated by routine RAM 2BF (0).

RX (I) or RX (IR) X coordinate of radar number I or IR where I and IR are running indexes on the variable.

RY (I) or RY (IR) Y coordinate of radar number I or IR where I and IR are running indexes on the variable.

S One half of the beamwidth, Q

SCALE Scale factor. This scale factor is used for an off-line Bendix display.

SEN (I) A variable generated for use by the off-line Bendix display facility. The variable is indexed by I.

SNR Signal to noise ratio. SNR is defined as follows:

$$\text{SNR} = \frac{\text{AG (SUMJ)}}{\text{SUMK}}$$

SR (I) or SR(K) Signal ratio where I or K is the running index on the variable.

ST (L) or ST (I) Temporary storage for azimuths which have been detected but not merged where L or I are the running indices.

SUMJ The sum of the range functions of the targets within the main beam when looking at target I as represented by jittered azimuth T (I).

SUMK The sum of the range functions of the k targets in the sidelobes when the main beam is looking at target I as represented by the jittered azimuth T (I).

T (I) or T (J) The azimuth of target I from radar IR. The azimuth is measured with the positive y axis as reference and with clockwise rotation as the positive sense. J is also a running index on the variable.

TC Temporary storage for C (I).

TEMPR Temporary storage for the range function corresponding to the azimuth in TEMPT.

TEMPT Temporary storage for one azimuth in the azimuth sorting routine.

TPI 2 π to eight decimal places.

TRG Title for target number.

TT or T Title for Output Data Type Code.

TW Temporary storage for W (I).

V (I) Target run length or sector width, i.e., the azimuth difference of the trailing edge less the leading edge.

W (I) Center azimuth of a sector with the leading edge, ALPHA (I), and trailing edge, BETA (I). 1 is the running index on the variable.

X (I) X coordinate of target number I where I is a running index on the variable.

Y (I) Y coordinate of target number I where I is a running index on the variable.

1.1.3 FORTRAN Listing

```
      DIMENSION X(100),Y(100),PD(4),SR(4),RX(8),RY(8),DX(100),DY(100),
     XSEN(100),CES(100),T(100),K(100),ALPHA(100),BETA(100),W(100),
     XAI(100),BI(100),ST(100),V(100),C(100),RF(100),ET(5),S(5),Q(5)
      REWIND 4
      READ               600,NDS
  600 FORMAT(I5)
      PI=3.14159265
      TPI= 6.28318530
      IFL=0
      NO=100
      J=100
      LIMIT=0
      KLOCK=1
      DO 137 I=1,8
      RX(I)=0.
  137 RY(I)=0.
      DO 144 I=1,100
      X(I)=0.
  144 Y(I)=0.
      IF DIVIDE CHECK 670,670
  670 IF QUOTIENT OVERFLOW 138,138
   69 NDS=NDS-1
      IF(NDS)601,601,602
  601 END FILE 4
      REWIND 4
      PAUSE 209
      PAUSE
      PAUSE1
      PAUSE
      PAUSE 100
  602 READ               650,IM1,IM2,IM3,IM4
  650 FORMAT(4I4)
      READ 1,ID,NO,NR,IFL,MAXLIM,SCALE,RFL,AG
    1 FORMAT(5I5,F7.2,F10.8,F8.2)
      WRITE OUTPUT TAPE 4,55,ID,NO,NR,MAXLIM
   55 FORMAT (4I15)
C     TARGET INPUTS
      READ               2,(X(I),Y(I),I=1,NO)
    2 FORMAT(2F7.2)
```

```
C     DETECTOR LOCUS
      READ              2,(RX(I),RY(I),I=1,NR)
      NIL=0
      KLOCK=0
      MAR=16
      DO 1000 I = 1,NR,4
      WRITE OUTPUT TAPE 4,26,(ID,KLOCK,MAR,NIL,RX(I),RY(I),RX(I+1),
     1RY(I+1),RX(I+2),RY(I+2),RX(I+3),RY(I+3))
      IF(SENSE SWITCH 1)93,1000
   93 PUNCH                 26,(ID,KLOCK,MAR,NIL,RX(I),RY(I),RX(I+1),
     1RY(I+1),RX(I+2),RY(I+2),RX(I+3),RY(I+3))
 1000 CONTINUE
C     PROBABILITY AND SR TABLES
      READ 3,           (PD(I),I=1,4)
    3 FORMAT(4F5.2)
      READ             4,(SR(I),I=1,4)
    4 FORMAT(4F5.0)
C     PROGRAM CONSTANTS
      DO 350I = 1,NR
  350 READ 5,(ET(I),S(I),Q(I))
    5 FORMAT(3F6.3)
      GO TO 70
    7 IFL=IFL-1
      IF(IFL) 69,69,70
C     VARIABLE INPUT
   70 READ              6,(A,B,LIMIT)
    6 FORMAT(2F4.0,I5)
      READ              2,(DX(I),DY(I),I=1,NO)
      LA=A
      LB=B
C     CHECK MODE CONTROL
      IF(A)8,12,12
    8 KPLB=KLOCK+LB
      IF(LIMIT-KPLB)151,152,152
  151 B=FLOATF(LIMIT-KLOCK)
      KLOCK=LIMIT
      GO TO 153
  152 KLOCK=KLOCK+LB
  153 DO 9 I=1,NO
      X(I)=X(I)+B*DX(I)
    9 Y(I)=Y(I)+B*DY(I)
      LA=ABSF(A)
   12 LAP=LA
   65 KLOCK=KLOCK+1
      IF(LIMIT-KLOCK)150,99,99
  150 KLOCK=KLOCK-1
      GO TO 7
   99 ASSIGN 28 TO JLB
```

```
      NRD=0
      IR=1
      DO 13 I=1,NO
      X(I)=X(I)+DX(I)
   13 Y(I)= Y(I)+DY(I)
C     CALCULATION OF RANGE FUNCTION AND AZIMUTH
   14 IRP=IR
      DO 15 I=1,NO
      RF(I)=1./((X(I)-RX(IRP))**2.+(Y(I)-RY(IRP))**2.)
      IF DIVIDE CHECK 23,115
  115 IF(RF(I)-RFL)624,835,835
  835 T(I)=ATN1F((RX(IR)-X(I)),(Y(I)-RY(IR)))
      IF(T(I)) 21,21,123
  123 T(I)=TPI-T(I)
   21 RN=RAM2BF(0)
      T(I) = T(I)+ET(IRP)*(RN-.5)
      IF(T(I)-TPI)18,19,19
   19 T(I)=T(I)-TPI
      GO TO 15
   18 IF(T(I))20,15,15
   20 T(I)=T(I)+TPI
      GO TO 15
   23 T(I)=-1.
      GO TO 15
  624 T(I)=-2.
   15 CONTINUE
      IF(IM1)500,501,500
  501 WRITE OUTPUT TAPE 6,502
  502 FORMAT(38H1 RUN CLK   T(I)        RF(I)          R)
      DO 503  I=1,NO
  503 WRITE  OUTPUT TAPE 6, 513,ID,KLOCK,T(I),RF(I),IR
  513 FORMAT(I5,I4,F8.3,F18.8.I3)
  500 GO TO JLB,(28,27)
C     TARGFT OUTPUT
   28 I=1
      MY=6
      MX=11
      MARG=-3
      DO 25 I=1,NO,4
      MARG=MARG+4
      IF (SENSE SWITCH 1) 1001,25
 1001 PUNCH                62,ID,KLOCK,MX,MY,MARG,X(I),Y(I),X(I+1),Y(I+1),
     XX(I+2),Y(I+2),X(I+3),Y(I+3)
   62 FORMAT (I5,I4,I3,2I2,8F6.1)
   25 WRITE OUTPUTTAPE 4,26,(ID,KLOCK,MX,MARG,X(I),Y(I),X(I+1),Y(I+1),
     XX(I+2),Y(I+2),X(I+3),Y(I+3))
   26 FORMAT(  I5,I4,I3,I4,8F8.2)
      ASSIGN 27 TO JLB
```

```
C       ORDERING AZIMUTHS (AND ASSOCIATED RANGES)
   27 IC=1
   34 IE=IC+1
   35 IF(T(IC)-T(IE))36,36,39
   36 IE=IE+1
      IF(IE-NO)35,35,37
   37 IC=IC+1
      IF(IC-NO)34,699,699
   39 TEMPT=T(IE)
      TEMPR=RF(IE)
      T(IE)=T(IC)
      RF(IF)=RF(IC)
      T(IC)=TEMPT
      RF(IC)=TEMPR
      GO TO 36
  699 IF(IM2)504,505,504
  505 WRITE OUTPUT TAPE 6,506
  506 FORMAT(17H  SORTED AZIMUTHS)
      DO 507 I=1,NO
  507 WRITE OUTPUT TAPE 6,513,ID,KLOCK,T(I),RF(I),IR
C       DETECTION
  504 NOL=1
      L=0
      ASSIGN 660 TO KTS
      DO 700 I=1,NO
      ASSIGN 710 TO KING
      IF(T(I))697,698,698
  697 NOL=NOL+1
      GO TO 799
  698 AI(I) = T(I)-S(IRP)
      IF(AI(I))701,702,702
  701 AI(I)=AI(I)+TPI
  702 BI(I)=T(I)+S(IRP)
      IF(BI(I)-TPI)703,704,704
  704 BI(I)=BI(I)-TPI
  703 SUM J=0.
      SUM K=0.
      IF(BI(I)-AI(I))706,706,705
  706 ASSIGN 711 TO KING
  705 DO 720 J=NOL,NO
  725 GO TO KING,(710,711)
  710 IF(AI(I)-T(J))707,708,709
  707 IF(BI(I)-T(J))709,708,708
  711 IF(BI(I)-T(J))712,708,708
  712 IF(AI(I)-T(J))708,708,709
  708 SUM J=SUM J + RF(J)
      GO TO 720
  709 SUM K= SUM K + RF(J)
  720 CONTINUE
      IF(SUMK) 718,718,759
  718 L=L+1
      ST(L)=T(I)
      GO TO 799
  759 SNR= AG*SUMJ/SUMK
      IF QUOTIENT OVERFLOW 761,758
  761 SNR= 0.
  758 DO 717 K=1,4
      IF(SNR-SR(K)) 717,716,716
  717 CONTINUE
      GO TO 799
  716 RN=RAM2BF(0)
      IF(PD(K)-RN) 799,714,714
  714 L=L+1
      ST(L)=T(I)
  799 IF(IM3) 700,715,700
  715 GO TO KTS,(660,665)
  660 WRITE OUTPUT TAPE 6,765
  765 FORMAT(111H  NOL  T(I)  S   AI(I) BI(I)      SUMJ             SUMK
     X           SNR        SR(K)  PD(K)    RN  ST(L)    K    L)
      ASSIGN 665 TO KTS
  665 WRITE OUTPUT TAPE6,767,(NOL,T(I),S(IRP),AI(I),BI(I),SUMJ,SUMK,SNR,
     XSR(K),PD(K),RN,ST(L)),K,L
  767 FORMAT(I5,F6.3,F5.3,2F6.3,3F16.6,2F7.2,F5.3,F6.3,2I5)
  700 CONTINUE
      IF(L) 300,300,96
   96 DO 97 I=1,L
   97 T(I)=ST(I)
      IF(IM4)42,762,42
  762 DO 763 I=1,L,4
  763 WRITE OUTPUT TAPE 6,764,T(I),T(I+1),T(I+2),T(I+3)
  764 FORMAT( 6H T(I)= 4F6.3)
C     MERGING
   42 J=1
      I=1
   98 ALPHA(J)=T(I)-S(IRP)
      IG=I
      ASSIGN 57 TO NX
      K(1)=1
      IF(ALPHA(J))44,45,45
   44 ALPHA(J)=ALPHA(J)+TPI
   45 BETA(J)=T(I)+Q(IRP)
      IF(BETA(J)-TPI)46,51,51
   46 IJ=I+1
      IF(I-L)48,52,52
   48 IF(BETA(J)-T(IJ))49,50,50
   49 BETA(J)=T(I)+S(IRP)
```

```
      J=J+1
   56 I=I+1
      ALPHA(J)=T(I)-S(IRP)
      K(J)=K(J)+1
      GO TO 45
   50 K(J)=K(J)+1
      I=I+1
      GO TO 45
   51 BETA(J)=BETA(J)-TPI
      IF(BETA(J)-T(IG))249,250,250
  250 GO TO NX, (57,58)
  249 BETA(J)=T(I)+S(IRP)
      IF(BETA(J)-TPI)54,251,251
  251 BETA(J)=BETA(J)-TPI
      GO TO 54
   57 ALPHA(1)=ALPHA(J)
      ASSIGN 58 TO NX
   58 K(1)=K(J)+K(1)
      K(J)=0
   54 IF(I-L)56,53,53
   52 BETA(J)=T(I)+S(IRP)
   53 IF(K(J))85,60,85
   60 ALPHA(J)=0.00
      BETA(J)=0.00
      J=J-1
      IF(J)300,300,85
   85 DO 61 I=1,J
      IF(BETA(I)-ALPHA(I))119,120,120
  119 ALPHA(I)=ALPHA(I)-TPI
  120 W(I)=(ALPHA(I)+BETA(I))/2.
      IF(W(I))121,122,122
  121 W(I)=W(I)+TPI
  122 SEN(I)= .2*RX(IR)/SCALE+ .4*SINF(W(I))+ .4
      CES(I)= .2*RY(IR)/SCALE+ .4*COSF(W(I))+ .4
      C(I)=W(I)*180./PI
      V(I)=BETA(I)-ALPHA(I)
      IF(ALPHA(I))43,61,61
   43 ALPHA(I)=ALPHA(I)+TPI
   61 CONTINUE
      IF(J-2)255,257,257
  257 IF(W(1)-W(2))255,255,256
  256 IE=J-1
      TW=W(1)
      TC=C(1)
      DO 258 I=1,IE
      W(I)=W(I+1)
  258 C(I)=C(I+1)
      W(J)=TW
      C(J)=TC
  255 MX=12
      DO 63 I=1,J,2
      IF (SENSE SWITCH 1) 63,1002
   63 PUNCH                     64, ID,KLOCK,MX,IR,C(I),C(I),SEN(I),CES(I),
     XC(I+1),C(I+1),SEN(I+1),CES(I+1)
   64 FORMAT (I5,I4,I3,I2,F6.3,F7.0,F5.3,2F6.3,F7.0,F5.3,F6.3)
 1002 MX=14
      WRITE OUTPUT TAPE 4,76,(ID,KLOCK,MX,IR,J)
      MX=13
      NRD=NRD+1
      DO 66 I=1,J,4
   66 WRITE OUTPUT TAPE 4,67,(ID,KLOCK,MX,IR,K(I),ALPHA(I),BETA(I),
     XK(I+1),ALPHA(I+1),BETA(I+1),K(I+2),ALPHA(I+2),BETA(I+2),K(I+3).
     YALPHA(I+3),BETA(I+3))
   67 FORMAT(I5,I4,I3,I2,I4,2F6.3,I4,2F6.3,I4,2F6.3,I4,2F6.3)
      MX=17
      DO 102 I=1,J,4
  102 WRITE OUTPUT TAPE 4,103,(ID,KLOCK,MX,IR,J,V(I),K(I),V(I+1),K(I+
     X,V(I+2),K(I+2),V(I+3),K(I+3))
  103 FORMAT(I5,I4,I3,I2.I3,F6.3,I4,F6.3,I4,F6.3,I4,F6.3,I4)
      MT=18
      DO 106 I=1,J,4
  106 WRITE OUTPUT TAPE 4,118, ID,KLOCK,MT,IR,W(I),W(I+1),W(I+2),W(I+3))
  118 FORMAT(I5,I4,I3,I2,4F10.3)
  138 DO 100  I=i,J
      V(I)=0.
      K(I)=0
      W(I)=0.
      C(I)=0.
      SEN(I)=0.
      CES(I)=0.
      ALPHA(I)=0.
  100 BETA(I)=0.
  300 DO 125  I=1,NO
  125 T(I)=0.
      IF(LIMIT-KLOCK)  7,68,68
   68 IF(IR-NR)80,81,81
   80 IR=IR+1
      GO TO 14
   81 LAP=LAP-1
      MX=19
      WRITE OUTPUT TAPE 4,76,(ID,KLOCK,MX,IR,NRD)
   76 FORMAT (I5,I4,I3,I2,I60)
      IF(LAP)8,8,65
      END(0,1,1,0,1)
```

1. 2 SECTION II - TRIANGULATION PROGRAM

1. 2. 1 Input/Output

There are four input cards prepared for Section II, they are:

Card 1: Number of data sets being processed.
Card 2: IM switches.
Card 3: Radar identifications.
Card 4: Azimuth limit angle, range of radars.

Card 1: The number of data sets is punched at a fixed point variable in the first five columns of the card.

NODSTS
1-5

Card 2: There are seven IM switches considered "on" if a zero is punched or "off" if a non-zero is punched in their fieid. The field for each switch in four columns designated as follows.

IM(1)	IM(2)	IM(3)	IM(4)	IM(5)	IM(6)	IM (7)
1-4	5-8	9-12	13-16	17-20	21-24	25-28

The function of each switch is as follows:

IM(1): Range from primary radar 2, point check.
IM(2): Output azimuth limits.
IM(3): List rotated azimuths after sorting.
IM(4): Intersection feasibility rejection.
IM(5): Azimuth limit and range limit rejections.
IM(6): Not used.
IM(7): Required azimuth point check and no sector overlap rejection.

Refer to output for detail definitions.

Card 3: There is provision for up to five radars in a single run. The first two are designated as the base radars and the remaining three as the secondary radars. The field for each radar identification is four columns designated as follows:

B1	B2	S1	S2	S3
1-4	5-8	9-12	13-16	17-20

The radars are numbered in order in Section I from 1 through 5. These identification numbers are punched in the fields of Card 2. Any two radars may be designated as the base radars and any or all of the remaining radars may be secondary. The ID is punched as a single digit fixed point variable.

Card 4: The azimuth limit angle, R_1, is designated as a floating point number in the first seven columns of the card in the form xxx.xxx. The angle is in radians. The range limit, RANGLT, and twice the range limit, TRANGL, are designated in Columns 8-15, and 16-23, respectively.

R	RANGLT	TRANGL
1-7	8-15	16-23

The range limits are designated in miles in the form xxxxx.xx.

There are three types of output from Section II; apparent targets, display data, and intermediate check data.

Apparent targets are outputted on tape unit 3 in the form of x and y coordinates. Along with the coordinates a listing is presented giving the strobes from each radar which yield an apparent target. The x and y coordinates are given in miles from the origin. The azimuths are given in radians.

Display data are outputted on punched cards under the control of sense switch 1. If the switch is down the coordinates of the apparent target positions are punched, four to a card. These cards are then processed for use in the display equipment.

Intermediate data are outputted on tape unit 6 under the control of the IM "switches." (See input data) This output is used specifically for test purposes and describes the several types of rejections. With this data all the strobes from each of the radars can be accounted for and hand-checked to assure the program is functioning properly.

1.2.2 Glossary

A The lower limit of a jammed sector calculated in Section I.

B The upper limit of a jammed sector calculated in Section I.

CG Temporary storage locations for the azimuth of an apparent target to the radar before output.

I General indexing constant.

IALRLK A sum of the number of azimuth limit rejections per frame. The last two letters indicate thc radars whose limits are being tested.

IC An index used in sorting rotated azimuths.

ICBM An assigned GO TO constant for selecting Right or Left Plane computation.

ICONL Number of radar combinations attempting triangulation.

ID Run Number.

IE An index used in sorting rotated azimuths.

IFC Count of the number of combinations of the strobes from the primary radars for which there is no intersection feasible.

IL An index used to keep track of the secondary radars used in Triangulation attempts.

IM1 to IM7 Intermediate output printed as specified by input card. See input-output for details.

IP A count of the number of apparent targets found in a given frame.

IR Radar identification number.

IX Temporary input storage for the number of sectors detected from a given radar.

J Identification number of a radar.

JD A temporary storage location for the radar identification number prior to a rejection output.

JF A temproary storage location for the radar identification number prior to a rejection output.

JJ An index for J radar strobes.

JJS Temporary output storage location for the identification number of the azimuth from radar J involved in a triangulation.

JOHNST An assigned GO TO Constant used as a conditional continue switch on intersection feasibility rejection.

JR Identification number of one of the prime radars.

JS Temporary output storage location for identifying a radar involved in a triangulation.

K Identification Number of a radar.

KK An index identifying a strobe from the Kth radar.

KKS Temporary output storage location for the identification number of the azimuth from radar K involved in a triangulation.

KLM A test constant used to indicate Right or Left Plane calculation.

KLOCK Frame number.

KM A dump storage for unused data taped in Section I.

KN A dump storage for unused data taped in Section I.

KO A dump storage for unused data taped in Section I.

KR Identification number of one of the prime radars.

KRJ A count of the number of range limit rejections from radar J.

KRK A count of the number of range limit rejections from radar K.

KRL A count of the number of range limit rejections from radar L.

KRQ A switching constant used to determine whether both the J and K azimuths have been rocated, sorted and outputted.

KSLBD An assigned GO TO Constant used to indicate the end of a frame.

KV Temporary output storage location for identifying a radar involved in a triangulation.

L Identification number of a radar.

LKLP An identification number indicating the last K azimuth in the left plane.

LKRP An identification number indicating the last K azimuth in the right plane.

LKSRP An index representing the identification number of the last strobe from radar KR in the right plane.

LL An index for L radar strobes.

LLS Temporary output storage location for the identification number of the azimuth from Radar L involved in a triangulation.

LR Identification numbers of secondary radars.

LS Temporary output storage location for identifying a radar involved in a triangulation.

LSK An index which keeps track of the first strobe in the left plane.

LT An assigned GO TO Constant used to indicate that all secondary radars have been tested.

M A temporary index used in calculating azimuth limits.

MA A temporary output constant.

MAR A temporary output index.

MARG A temporary output index.

MAXLIM The maximum number of frames in the run. Inputted on tape 4 from Section I.

MD A temporary output index.

ME A temporary output index.

MND An assigned GO TO constant used to indicate return point after a rejection output.

MNO An assigned GO TO constant used to indicate type of rejection output.

MO A temporary output index.

MOP An assigned GO TO constant used to indicate type of rejection output.

MX A temporary output constant.

MY A temporary output constant.

MZ A dump storage for unused data taped in Section I.

N A temporary index used in calculating azimuth limits.

NA, NB, NC, ND An input constant indicating the number of apparent targets in a strobe sector.

NIL An input constant indicating the identification number of the target positions.

NJ The number of strobes calculated by a given radar.

NO An input constant indicating the number of targets.

NODSTS Input data designating the number of cases being calculated.

NOR Number of radars in the run.

NR An input constant indicating the number of radars.

NSL A temporary counter which keeps track of the number of strobes from a secondary radar which have been tested.

NSTR An output index which keeps track of the strobe number being operated with after a range rejection has been encountered.

PI The mathematical constant π.

QA The width of a jammed sector in radians. Calculated in Section I.

QLIM Left limit of radars detecting sector.

R The geometric cutoff angle of the base radars.

RA The azimuth of one radar from another. For the base radars this is also the angle of rotation.

RANGLT An input constant representing the range of a radar.

RF Temporary data; the distance of an intersection from a base radar.

RLIM Right limit of a radar's detecting sector.

RLP Temporary data; the distance of an intersection from a secondary radar.

RQDA Temporary data; the azimuth of an intersection from a secondary radar.

RQLIM Rotated left limit of a radars detecting sector.

RRLIM Rotated right limit of a radars detecting sector.

RSV A temporary storage of RLP after a secondary radar range rejection.

RT Rotated bisectors of the jammed sectors calculated in Section I.

RTJ, RTK Rotated azimuths of the primary radars.

RX The x coordinate of a radar position.

RY The y coordinate of a radar position.

STAFJ The azimuth from the J radar involved in a triangulation.

STAFK The azimuth from the K radar involved in a triangulation.

STAFL The azimuth from the L radar involved in a triangulation.

T Bisectors of the jammed sectors calculated in Section I.

TE1, Te2, TE3 Temporary rejection output constants indicating RQDA, and right and left azimuth limits.

TEMP Temporary storage of rotated azimuth during sorting procedure.

TPI The mathematical value 2π.

TRANGL Input data equal to twice the range limit.

X The x coordinate of a true target.

XA The x coordinate of an apparent target.

XP The x coordinate of an intersection point.

XPT X coordinate of the midpoinc of the line joining the two base radars.

Y The Y coordinate of a true target.

YA The Y coordinate of an apparent target.

YP Y coordinate of an intersection point.

YPT Y coordinate of the midpoint of the line joining the two radars.

1. 2. 3 FORTRAN Listing

```
      DIMENSION RX(8),RY(8),X(100),Y(100),A(5,100),B(5,100),NJ(5),
     XLLS(25),NSLC(25),STAFJ(25),STAFK(25),JS(25),STAFL(25),JJS(25),
     XKV(25),KKS(25),LS(25),CG(25),RT(5,100),XA(25),YA(25),QA(100),
     XRA(5,5),QLIM(5,5),RLIM(5,5),RQLIM(5,5),RRLIM(5,5),NOR(5),T(5,100),
     XLR(5)
      DISF(C,D,E,F)=SQRTF((C-D)**2+(E-F)**2)
      RJPF(C,D,E,F,P,Q)=(DISF(C,D,E,F)*SINF(Q))/(SINF(P-Q))
      RKPF(C,D,E,F,P,Q)=(DISF(C,D,E,F)*SINF(P))/(SINF(P-Q))
      PI=3.14159265
      TPI=6.28318530
      REWIND 3
      REWIND 4
      READ 1107,NODSTS
 1107 FORMAT( I5)
  456 IF(NODSTS) 1108, 1108,1109
 1108 WRITE OUTPUT TAPE 3,1023
      K = 0
      A = 0
      WRITE OUTPUT TAPE 3,493,K,K,K,K,A,A,A,A,A,A,A,A
      REWIND 4
      END FILE 3
      REWIND 3
      PAUSE 209
      PAUSE
      PAUSE    1
      PAUSE
      PAUSE 100
 1109 NODSTS=NODSTS-1
      READ                446,IM1,IM2,IM3,IM4,IM5,IM6,IM7
  446 FORMAT(7I4)
      READ                446,JR,KR,LR(1),LR(2),LR(3),LR(4),LR(5)
      READ                490,R,RANGLT,TRANGL
  490 FORMAT(F7.4,2F8.2)
      READ INPUT TAPE 4,491,ID,NO,NR,MAXLIM
  491 FORMAT (4I15)
      DO 492 I=1,NR,4
  492 READ INPUT TAPE 4,493,ID,KLOCK,MA,NIL,RX(I),RY(I),RX(I+1),RY(I+1),
     XRX(I+2),RY(I+2),RX(I+3),RY(I+3)
  493 FORMAT(I5,I4,I3,I4,8F8.2)
C     CALCULATE RA AND SECTOR LIMITS
      M = KR
      N = JR
      IF(DISF(RX(JR),RX(KR),RY(JR),RY(KR)) - TRANGL) 673,672,67.
  673 XPT = .5*(RX(JR) + RX(KR))
      YPT = .5*(RY(JR) + RY(KR))
  668 RA(M,N) = ATN1F((RX(M)-RX(N)), (RY(N)-RY(M)))
      IF (RA(M,N)) 190,199,190
  190 RA(M,N) = TPI - RA(M,N)
  199 RA(N,M) = RA(M,N) + PI
      IF (RA(N,M) - TPI) 194,195,195
  195 RA(N,M) = RA(N,M) - TPI
  194 QLIM(M,N) = RA(M,N) - R
      IF(QLIM(M,N)) 477,478,478
  477 QLIM (M,N) = QLIM(M,N) + TPI
  478 RLIM (M,N) = RA(M,N) + R
      IF (RLIM(M,N) - TPI) 479,480,480
  480 RLIM(M,N) = RLIM(M,N) - TPI
  479 IF (RX(N) - RX(M)) 305,304,11
   11 RA(M,N) = - RA(M,N)
      GO TO 304
  305 RA(M,N) = TPI - RA(M,N)
  304 QLIM(N,M) = QLIM(M,N) + PI
      IF (QLIM(N,M) - TPI) 177,178,178
  178 QLIM(N,M) = QLIM(N,M) - TPI
  177 RLIM(N,M) = RLIM(M,N) + PI
      IF(RLIM(N,M) - TPI) 179,180,180
  180 RLIM(N,M) = RLIM(N,M) - TPI
  179 RQLIM(M,N) = QLIM(M,N) + RA(KR,JR)
      IF (RQLIM(M,N)) 170,172,171
  170 RQLIM(M,N) = RQLIM(M,N) + TPI
  171 IF (RQLIM(M,N) -TPI) 172,173,173
  173 RQLIM(M,N) = RQLIM(M,N) - TPI
  172 RRLIM(M,N) = RLIM(M,N) + RA(KR,JR)
      IF (RRLIM(M,N)) 156,158,157
  156 RRLIM(M,N) = RRLIM(M,N) + TPI
  157 IF (RRLIM(M,N) - TPI) 158,159,159
  159 RRLIM(M,N) = RRLIM(M,N) - TPI
  156 IF(M - L) 154,162,154
  154 RQLIM(N,M) = RQLIM(M,N) + PI
      IF(RQLIM(N,M) - TPI)160,161,161
  161 RQLIM(N,M) = RQLIM(N,M) - TPI
  160 RRLIM(N,M) = RRLIM(M,N) + PI
      IF (RRLIM(N,M) - TPI) 162,174,174
  174 RRLIM(N,M) = RRLIM(N,M) - TPI
  162 IF(IM2) 489,205,489
  205 WRITE OUTPUT TAPE 6,206,N,M,RA(N,M),QLIM(N,M),RLIM(N,M),RQLIM(N,M)
     X,RRLIM(N,M)
      WRITE OUTPUT TAPE 6,206,M,N,RA(M,N),QLIM(M,N),RLIM(M,N),RQLIM(M,N)
     X,RRLIM(M,N)
  206 FORMAT (2I3,5F8.2)
C     CLEARING
672   CONTINUE
  489 DO 487 I=1,5
      NJ(I)=0
  487 NOR(I)=0
      DO 300 IZ=1,5
      DO 300 I= 1,100
      RT(IZ,I)=0.
  300 T(IZ,I)= 0.
      ICONL=0
      KLM = 0
C     READ ENVIRONMENT DATA
      DO 494 I=1,NO,4
  494 READ INPUT TAPE 4,493,ID,KLOCK,MA,NIL,X(I),Y(I),X(I+1),Y(I+1),
     XX(I+2),Y(I+2),X(I+3),Y(I+3)
  488 READ INPUT TAPE 4,495,ID,KLOCK,MX,IR,IX
  495 FORMAT ( I5,I4,I3,I2,I60)
      IF(MX-14)496,496,497
  497 IF(IX-3) 455,505,505
  455 IF(MAXLIM-KLOCK)456,456,489
  496 DO 498 I=1,IX,4
  498 READ INPUTTAPE4,499,ID,KO,MZ,IR,NA,A(IR,I),B(IR,I),NB,A(IR,I+1),
     XB(IR,I+1),NC,A(IR,I+2),B(IR,I+2),ND,A(IR,I+3),B(IR,I+3)
  499 FORMAT(I5,I4,I3,I2,I4,2F6.3,I4,2F6.3,I4,2F6.3,I4,2F6.3)
      NOR(IR)=IR
      NJ(IR)= IX
      DO 502 I=1,IX,4
  502 READ INPUT TAPE 4,500,ID,KO,MZ,IR,IX,QA(I),NA.QA(I+1),NB,QA(I+2),
     XNC,QA(I+3),ND
  500 FORMAT(I5,I4,I3,I2,I3,F6.3,I4,F6.3,I4,F6.3,I4,F6.3,I4)
      DO 503 I=1,IX,4
  503 READ INPUT TAPE 4,501,ID,KM,KN,MZ,T(IR,I),T(IR,I+1),T(IR,I+2),
     XT(IR,I+3)
  501 FORMAT(I5,I4,I3,I2,4F10.3)
      GO TO 488
C     RADAR SELECTION
```

```
  505 J = JR
      K = KR
      ASSIGN 678 TO JOHNST
      LKRP = NJ(K)
      LKLP = NJ(K)
      JJ = 1
      KK = 1
      IF (NOR(J)) 400,489,400
  400 IF (NOR(K)) 401,489,401
  401 IL=1
  404 L = LR(IL)
      IF (L) 402,403,402
  402 IF (NOR(L)) 674,403,674
  403 IL = IL + 1
      IF (IL - NR + 2) 404,404,489
  674 KRJ=0
      KRK=0
      KRL=0
      IALRJK=0
      IALRJL=0
      IALRKJ=0
      IALRKL=0
      IALRLJ=0
      IALRLK=0
      IFC=0
      ICONL=ICONL+1
      KNIT=0
      LL= 1
      IP=0
C     ROTATING ANGLES FOR J + K
   31 KRQ=-1
      MD = J
      ME = NJ(J)
   32 DO 33 IT = 1,ME
      RT(MD,IT) = T(MD,IT) + RA(K,J)
      IF(RT(MD,IT)-TPI) 34,35,35
   35 RT(MD,IT)= RT(MD,IT)-TPI
   34 IF(RT(MD,IT)) 36,33,33
   36 RT(MD,IT) = RT(MD,IT) + TPI
   33 CONTINUE
      IF(KRQ)37,38,38
   37 KRQ=1
      MD= K
      ME = NJ(K)
      GO TO 32
C     SORTING RT(J,JJ) + RT(K,KK)
   38 KRQ=-1
      MD= J
   39 IC=1
      IF(NJ(MD)-1)45,45,40
   40 IE=IC+1
   41 IF(RT(MD,IC)-RT(MD,IE)) 42,42,43
   42 IE=IE+1
      IF(IE-NJ(MD)) 41,41,44
   43 TEMP= RT(MD,IE)
      RT(MD,IE)= RT(MD,IC)
      RT(MD,IC)= TEMP
      GO TO 42
   44 IC=IC+1
      IF(IC-NJ(MD)) 40,45,45
   45 IF(KRQ)46,47,47
   46 KRQ=1
      MD=K
      GO TO 39
C     INTERMEDIATE FOR SORTED ROTATED AZIMUTHS
   47 IF(IM3) 52,553,52
  553 KRQ=-1
      ME=NJ(J)
      MD =J
      WRITE OUTPUT TAPE 6,801,KLOCK
  801 FORMAT (17H          KLOCK = I5)
   51 DO 48 MO=1,ME,4
   48 WRITE OUTPUT TAPE 6,49,MD,ME,RT(MD,MO),RT(MD,MO+1),RT(MD,MO+2),
     XRT(MD,MO+3)
   49 FORMAT(15H J, JJ,RT(J,JJ)= 2I4,4F8.2)
      IF(KRQ)50,52,52
   50 KRQ=1
      MD=K
      ME= NJ(K)
      GO TO 51
C     CHECK RIGHT PLANE J AND K AZIMUTHS AGAINST ROTATED JK AND KJ
C     AZIMUTH LIMITS
   52 ASSIGN 405 TO LT
      IF (RT(J,JJ) - RQLIM(J,K)) 53,54,54
53    KLM = -1
   56 IF (RT(K,KK) - RRLIM(K,J)) 57,58,58
   57 RF = RRLIM (K,J)
      IALRKJ=IALRKJ+1
      ASSIGN 59 TO MNP
   60 ASSIGN 56 TO ICBM
      JD = K
      NSTR= KK
      ASSIGN 135 TO MNO
      ASSIGN 131 TO MOP
      GO TO 82
   58 IF(RT(K,KK) - RQLIM(J,K)) 64,65,65
   65 LKRP= KK-1
      IALRJK=IALRJK+1
      LKSR= KK-1
      RF = RQLIM (J,K)
      ASSIGN 321 TO MNP
      GO TO 60
C     INCREMENT STROBE NUMBERS - RIGHT PLANE
   59 KK=KK+1
      IF(KK-LKRP) 320,320,321
  320 GO TO ICBM,(56,58)
  321 JJ=JJ+1
      ASSIGN 678 TO JOHNST
      IF(JJ -NJ(J)) 322,322,722
  322 KK=1
      GO TO 52
C     CHECK LEFT PLANE J AND K AZIMUTHS AGAINST ROTATED JK AND KJ
C     AZIMUTH LIMITS
   54 IF(KLM) 370,371,371
  370 KK=LKRP+1
      GO TO 372
  371 KK=1
  372 KLM=1
      ASSIGN 678 TO JOHNST
      LSK=KK
  329 IF (RT(J,JJ) - RRLIM(J,K)) 349,349,328
  328 IF (RT(K,KK) - RRLIM(J,K)) 348,348,333
  349 ASSIGN 350 TO MNP
      IALRJK=IALRJK+1
      JD = J
      NSTR = JJ
      RF = RRLIM(J,K)
      GO TO 347
  333 IF (RT(K,KK) - RQLIM(K,J)) 382,335,335
  335 ASSIGN 350 TO MNP
      IALRJK=IALRJK+1
      RF = RQLIM(J,K)
      GO TO 346
  348 ASSIGN 330 TO MNP
      IALRKJ=IALRKJ+1
      RF = RRLIM(J,K)
  346 JD = K
      NSTR = KK
  347 ASSIGN 135 TO MNO
      ASSIGN 131 TO MOP
      GO TO 82
C     INCREMENT STROBE NUMBERS - LEFT PLANE
  350 JJ=JJ+1
      IF(JJ -NJ(J)) 380,380,722
  380 KK=LSK
      GO TO 329
  330 KK=KK+1
      IF(KK-LKLP) 328,328,350
  722 ASSIGN 489 TO KSLBD
      GO TO 63
C     CHECK INTERSECTION FEASIBILITY
```

```
C     LEFT PLANE
  382 RTJ=RT(K,KK)
      RTK=RT(J,JJ)
      GO TO 325
C     RIGHT PLANE
   64 RTJ= RT(J,JJ)
      RTK= RT(K,KK)
  325 IF(RTJ-RTK)1001,1001,1000
 1001 IFC = IFC + 1
      IF(IM4)326,950,326
  950 WRITE OUTPUT TAPE 6,1013,J,JJ,(RT(J,JJ)),K,KK,(RT(K,KK))
 1013 FORMAT (30H NO INTERSECTION FEASIBILITY  2I4,F5.2,2I4,F5.2)
      IF (KLM) 326,326,330
  326 ASSIGN 58 TO ICBM
      GO TO 321
C     CHECK RANGE FROM J
 1000 RF=RJPF(RX(J),RX(K),RY(J),RY(K),RT(J,JJ),RT(K,KK))
      IF(RF-RANGLT)76,76,77
   77 JD=J
      KRJ=KRJ+1
      NSTR =JJ
  331 IF(KLM) 78,78,79
   78 ASSIGN 321 TO MNP
  681 ASSIGN 131 TO MOP
  332 ASSIGN 130 TO MNO
      GO TO 82
   79 ASSIGN 130 TO MNO
      ASSIGN 131 TO MOP
  334 ASSIGN 330 TO MNP
C     INTERMEDIATE OUTPUT FOR AZIMUTH LIMIT AND RANGE REJECTIONS
   82 IF(IM5) 128,559,128
  559 GO TO MNO,(130,135)
  130 WRITE OUTPUT TAPE 6,1003,JD
 1003 FORMAT (31H RANGE LIMIT REJECTION ON RADAR I2)
      GO TO 129
  135 WRITE OUTPUT TAPE 6, 1004, JD,NSTR
 1004 FORMAT(45H SECTOR LIMIT REJECTION ON RADAR AND STROBE = 2I4)
  129 GO TO MOP,(131,132,136,137)
  131 WRITE OUTPUT TAPE 6,1005,JD,NSTR,RT(JD,NSTR),RF
 1005 FORMAT(33H RADAR,STROBE,ROTATED AZIMUTH,RF= 2I4,F6.2,F16.2)
      GO TO 128
  132 WRITE OUTPUT TAPE 6,1006,JD,RLP
 1006 FORMAT(18H RADAR L,RF OF L = I4,F8.2)
      GO TO 128
  136 WRITE OUTPUT TAPE 6,1007,JD,NSTR,JF,TE1,TE2,TE3
 1007 FORMAT(48H R1,STB,R2,RT(R1,STB),RQLIM(R1,R2),RRLIM(R1,R2)=3I4,
     X3F8.2)
      GO TO 128
  137 WRITE OUTPUT TAPE 6,1008,JD,NSTR,TE1,TE2,TE3
 1008 FORMAT(36H R1,R2,RQDA,QLIM(R1,R2),RLIM(R1,R2)=2I4,3F8.2)
```

```
  128 GO TO LT,(405,407)
  407 IL = IL + 1
      IF (IL - NR + 2) 406,406,405
  405 ASSIGN 405 TO LT
      IL=1
      GO TO MNP,(59,321,330,350)
C     CHECK RANGE FROM K
   76 RF=RKPF(RX(J),RX(K),RY(J),RY(K),RT(J,JJ),RT(K,KK))
      IF(IM1) 299,298,299
298   WRITE OUTPUT TAPE 6,297,J,JJ,(RT(J,JJ)),K,KK,(RT(K,KK)),RF
297   FORMAT(33H  J,JJ,RT(J,JJ),K,KK,RT(K,KK),RF=2I3,F6.3,2I3,F6.3,F9.2)
299   IF(RF-RANGLT)83,83,84
   84 JD=K
      KRK=KRK+1
      NSTR=KK
      GO TO JOHNST,(678,331)
  678 IF(DISF(RX(J),RX(K),RY(J),RY(K))-RANGLT) 331,331,677
  677 IF(KLM) 680,680,695
  680 ASSIGN 59 TO MNP
      ASSIGN 58 TO ICBM
      GO TO 681
  695 ASSIGN 350 TO MNP
      ASSIGN 131 TO MOP
      ASSIGN 130 TO MNO
      GO TO 82
C     CALCULATE COORDINATES OF INTERSECTION POINTS
   83 XP = RX(K) +RF* SINF(RT(K,KK) - RA(K,J))
      YP = RY(K) +RF* COSF(RT(K,KK) - RA(K,J))
      IF(KLM) 688,688,692
  688 ASSIGN 331 TO JOHNST
      GO TO 693
  692 ASSIGN 678 TO JOHNST
  693 KNIT = KNIT+1
  406 ASSIGN 407 TO LT
C     CHECK RANGE FROM L
      L = LR(IL)
      IF (L) 408,352,408
  408 RLP=DISF(XP,RX(L),YP,RY(L))
      IF(RLP- RANGLT) 88,88,87
   87 JD=L
      KRL=KRL+1
      RSV=RLP
      IF(KLM) 337,337,338
  337 ASSIGN 132 TO MOP
      ASSIGN 130 TO MNO
      ASSIGN 321 TO MNP
      GO TO 82
  338 ASSIGN 130 TO MNO
      ASSIGN 132 TO MOP
      GO TO 334
C     CALCULATE RQDA
```

```
   88 RQDA=ATN1F((RX(L)-XP),(YP-RY(L)))
      NSL=1
      IF(RQDA) 192,193,192
  192 RQDA= TPI - RQDA
  193 IF(IM7)100,840,100
  840 WRITE OUTPUT TAPE 6,1009,XP,YP,RQDA
 1009 FORMAT(12H XP,YP,RQDA= 3F8.2)
C     CHECK SECTOR OVERLAP
  100 IF(A(L,LL)-B(L,LL))101,101,102
  101 IF (B(L,LL) - RQDA)103,118,104
  103 LL=LL+1
      NSL=NSL+1
      IF(LL-NJ(L))100,100,1060
 1060 NSL=NSL-1
  106 IF(IM7)352,1111,352
 1111 WRITE OUTPUT TAPE 6,1010,L,LL,A(L,LL),B(L,LL),RQDA
 1010 FORMAT(22H L,LL,ALPHA,BETA,RQDA= 2I4,3F8.2)
  352 LL=1
      IL = IL + 1
      IF (IL - NR + 2) 406,406,61
   61 IF(KLM) 354,354,330
  354 ASSIGN 58 TO ICBM
      IL=1
      LL=1
      GO TO 59
  104 IF(A(L,LL) - RQDA) 118,118,106
  102 IF (A(L,LL) - RQDA) 118,118,107
  107 IF (B(L,LL) - RQDA) 103,118,118
C     DATA STORAGE FOR SUCCESSFUL TRIANGULATION
  118 IP=IP+1
      XA(IP)=XP
      YA(IP)=YP
      NSLC(IP)= NSL
      JS(IP)= J
      JJS(IP)=JJ
      KV(IP)= K
      KKS(IP)=KK
      LS(IP)= L
      LLS(IP)=LL
      STAFJ(IP)= T(J,JJ)
      STAFK(IP)=T(K,KK)
      STAFL(IP)=T(L,LL)
      CG(IP)=  RQDA
      ASSIGN 405 TO LT
      IF(IP- 25) 61,720,720
  720 ASSIGN 725 TO KSLBD
C     DATA OUTPUT
   63 WRITE OUTPUT TAPE 3,1027
 1027 FORMAT(79H1 RUN CLK TT   NAT   RFJ   RFK   RFL   NIF   ALRJK    KJ    JL
     6 KL    LJ    LK   ATP   CON)
      MX=22
      MY=23
      WRITE OUTPUT TAPE 3,1012,ID,KLOCK,MX,IP,KRJ,KRK,KRL,IFC,IALRJK,IAL
     1RKJ,IALRJL,IALRKL,IALRLJ,IALRLK,KNIT,ICONL
 1012 FORMAT (I5,I4,I3,5I5,I7,7I5)
      WRITE OUTPUT TAPE 3,1023
 1023 FORMAT(77H  RUN CLK T TRG     XA        YA        XA      YA        XA
     X   YA        XA        YA)
      MARG=- 3
      MX=21
      MA=7
      DO 73 MO = 1,IP,4
      MARG= MARG+4
      WRITE OUTPUT TAPE 3, 493,ID,KLOCK,MX,MARG,XA(MO),YA(MO),XA(MO+1),
     XYA(MO+1),XA(MO+2),YA(MO+2),XA(MO+3),YA(MO+3)
      IF(SENSE SWITCH 1)  220,73
  220 IF (IP) 1021,73,1021
 1021 PUNCH             1020,ID,KLOCK,MX,MA,MARG,XA(MO),YA(MO),XA(MO+1)
     7,YA(MO+1),XA(MO+2),YA(MO+2),XA(MO+3),YA(MO+3)
 1020 FORMAT (I5,I4,I3,2I2,8F6.1)
   73 CONTINUE
 1022 FORMAT(I5,I4,I3,2I2,8F8.2)
      WRITE OUTPUT TAPE 3,166
  166 FORMAT(75H  RUN CLK TT TGT     J    JJ TA(J)     K     KK TA(K)  NSL
     X L    LL TA(L)  RQDA)
      MAR=0
      DO 1100 MZ=1,IP
      MAR=MAR+1
 1100 WRITE OUTPUT TAPE 3,1026,ID,KLOCK,MY,MAR,JS(MZ),JJS(MZ),(STAFJ(MZ)
     X),KV(MZ),KKS(MZ),(STAFK(MZ)),NSLC(MZ),LS(MZ),LLS(MZ),(STAFL(MZ)),
     XCG(MZ)
 1026 FORMAT(I5,I4,I3,I4,2I5,F6.3,2I5,F6.3,3I5,2F6.3)
      DO 1025 MO=1,IP
      JS(MO)=0
      JJS(MO)=0
      STAFJ(MO)=0.
      KV(MO)=0
      KKS(MO)=0
      NSLC(MO)=0
      STAFK(MO)=0.
      LS(MO)=0
      LLS(MO)=0
      STAFL(MO)=0.
      CG(MO)=0.
      XA(MO)=0.
 1025 YA(MO)=0.
      IF(MAXLIM-KLOCK)456,456,216
  216 GO TO KSLBD, (725,489)
  725 IP=0
      GO TO 61
      END(0,1,1,0,1)
```

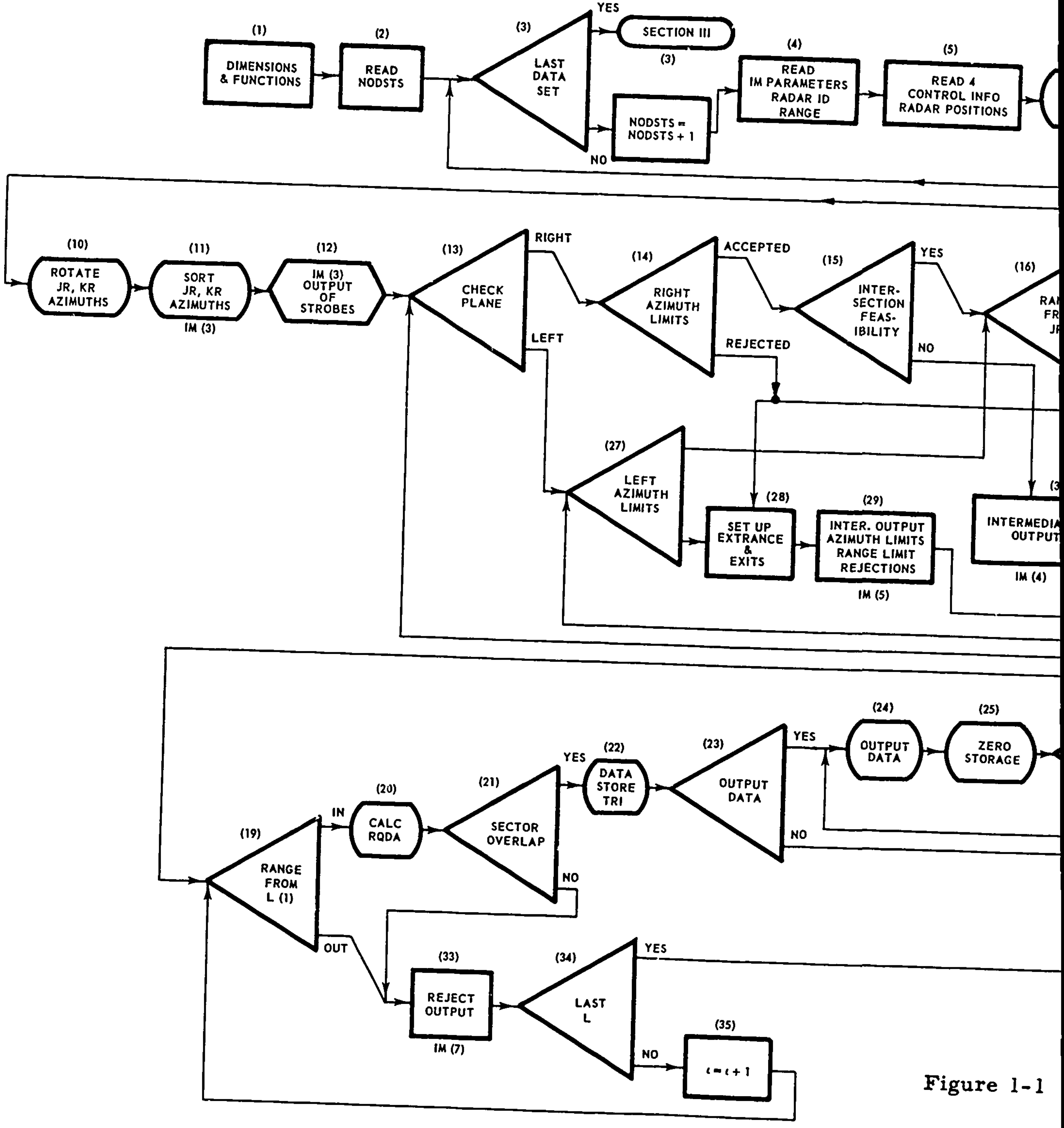
(1)
DIMENSIONS & FUNCTIONS
(2)
READ NODSTS
(3)
LAST DATA SET
YES
SECTION III
(3)
NO
NODSTS = NODSTS + 1
(4)
READ IM PARAMETERS RADAR ID RANGE
(5)
READ 4 CONTROL INFO RADAR POSITIONS
(10)
ROTATE JR, KR AZIMUTHS
(11)
SORT JR, KR AZIMUTHS
IM (3)
(12)
IM (3) OUTPUT OF STROBES
(13)
CHECK PLANE
RIGHT
LEFT
(14)
RIGHT AZIMUTH LIMITS
ACCEPTED
REJECTED
(15)
INTER-SECTION FEAS-IBILITY
YES
NO
(16)
RA FR JR
(27)
LEFT AZIMUTH LIMITS
(28)
SET UP EXTRANCE & EXITS
(29)
INTER. OUTPUT AZIMUTH LIMITS RANGE LIMIT REJECTIONS
IM (5)
(3
INTERMEDIA OUTPUT
IM (4)
(19)
RANGE FROM L (1)
IN
OUT
(20)
CALC RQDA
(21)
SECTOR OVERLAP
YES
NO
(22)
DATA STORE TRI
(23)
OUTPUT DATA
YES
NO
(24)
OUTPUT DATA
(25)
ZERO STORAGE
(33)
REJECT OUTPUT
IM (7)
(34)
LAST L
YES
NO
(35)
ι = ι + 1

Figure 1-1

A

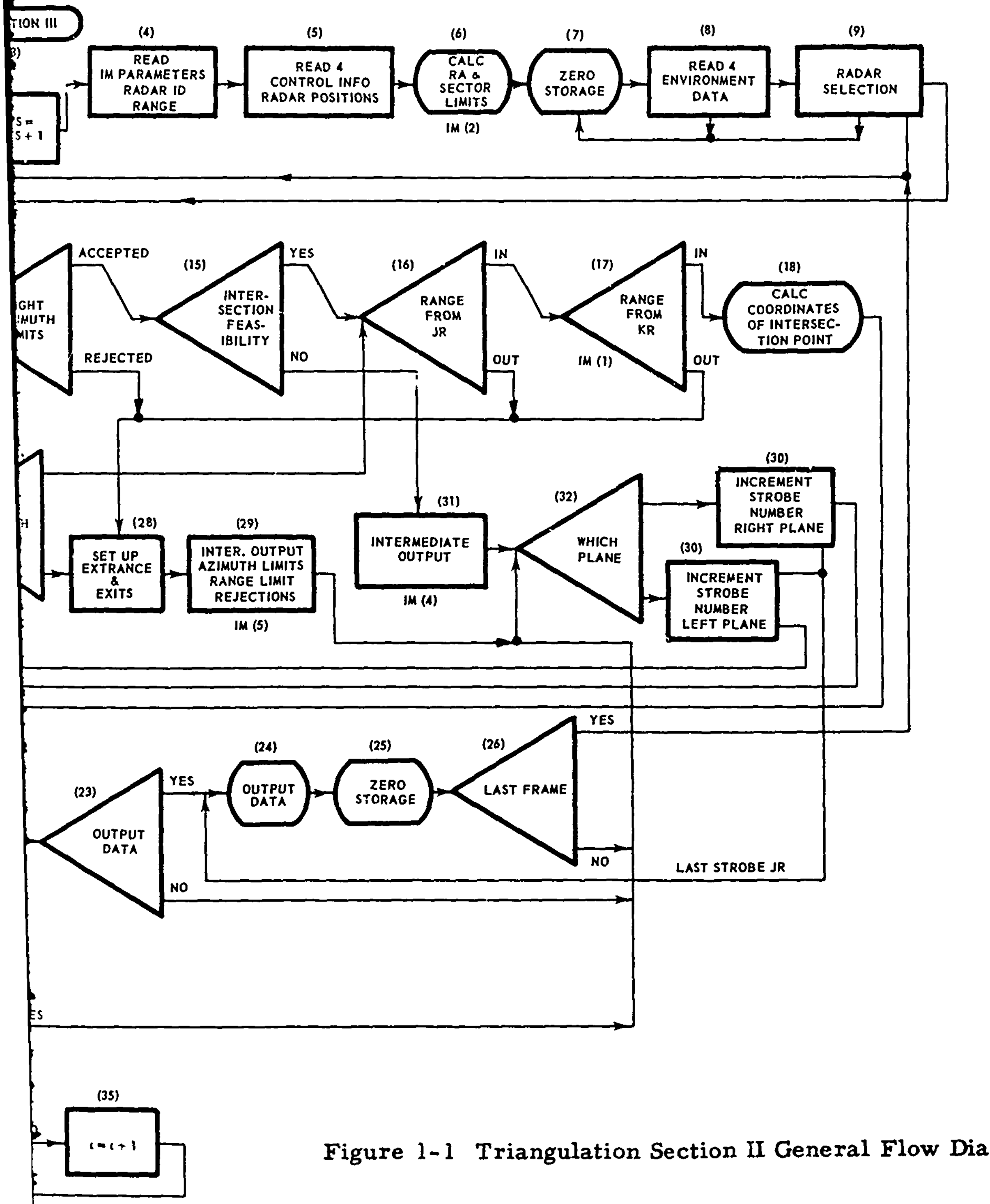

Figure 1-1 Triangulation Section II General Flow Diagram

B

1.3 SECTION III - DATA REDUCTION

1.3.1 Input/Output

There are eleven input cards prepared for Section II as follows:

Card 1.	Number of data sets being processed
Card 2	IM switches
Cards 3 & 4	Histogram switches
Cards 5 & 6	Maximum value of intervals
Cards 7 & 8	Interval size
Card 9	Target and sector cutoffs
Card 10	Number of frames to be processed
Card 11	Radar ID and range.

Card 1 The number of data sets is punched as a fixed point variable in the first five columns of the card.

NODSTS
1-5

Card 2 There are four IM switches considered "on" if a zero is punched; or "off", if a non-zero is punched in their field. The field for each switch is five columns designated as follows:

IM(1)	IM(2)	IM(3)	IM(4)
1-5	6-10	11-15	16-20

The function of each switch is as follows:

IM(1) Calculate means and standard deviation of histograms for each frame and output information on tape 6.

IM(2) List the true targets with the nearest apparent target and vice versa for each frame on tape 6.

IM(3) List misses, hits and false alarms for each frame on tape 6.

IM(4) Not used.

Cards 3 & 4 There are fifteen possible histograms which may be calculated depending upon the setting of the histogram "switches". Like the IM switches they are considered "on" if a zero is punched, or "off" if a non-zero is punched in their field. The field for each switch is seven columns distributed between cards 3 and 4 as follows:

Card 3	IH(1)	IH(2)	IH(3)	IH(4)	IH(5)	IH(6)	IH(7)
	1-7	8-14	15-21	22-28	29-35	36-42	43-49
	IH(8)	IH(9)					
	50-56	57-63					

Card 4	IH(10)	IH(11)	IH(12)	IH(13)	IH(14)	IH(15)
	1-7	8-14	15-21	22-28	29-35	26-42

The histograms are all frequency distribution tables. The descriptions of the fifteen histograms are as follows:

Histogram ID Description

1. Misses: frequency; number of true targets; distribution; distance between true target and nearest apparent.

2. Hits: frequency; number of true targets; distribution; distance between true target and nearest apparent target.

3. False alarms: frequency; number of apparent targets; distribution; distance between apparent target and nearest true target.

4. Misses and Hits: Accumulation of data from histograms 1 and 2.

5. Hits and false alarms: Accumulation of data from histograms 2 and 3.

6. Strobe width: frequency; number of strobes: distribution; width of strobes in degrees. A separate histogram is calculated for each radar.

7. Strobe width: An accumulation of the data from all the radars in histograms 6.

8. Number of targets per sector: frequency; number of sectors with X targets: distribution: number of targets. A separate histogram is calculated for each radar.

9. Number of targets per sector: An accumulation of the data from all radars in histograms 8.

10. Number of sectors with K targets or more: This histogram is the same as number 8, except that sectors with less than K targets (input data KTARG) are omitted.

11. Number of sector with K targets or more: This histogram is the same as number 9, except that sector with less than K targets are omitted.

12. Number of targets in sectors of width L degrees or greater: This histogram is the same as number 8, except that sectors of less than L degrees (input data SWLD) are omitted.

13. Number of targets in sectors of width L degrees or greater: This histogram is the same as number 9, except that sectors of less than L degrees are omitted.

14. Number of strobe sectors: This is not a histogram, only a list of the number of sectors detected for each radar.

15. Number of strobe sectors: A list of the number of strobes detected by all radars.

Cards 5 and 6: Associated with each histogram designated in cards 3 and 4 is a maximum distribution interval. These values are punched in floating point notation of the form XXX.XX and are distributed on cards 5 and 6 as follows:

Card 5:	AMXM(1)	AMXM(2)	AMXM(3)	AMXM(4)
	1-7	8-14	15-21	22-28

AMXM(5)	AMXM(6)	AMXM(7)	AMXM(8)	AMXM(9)
29-35	36-42	43-49	50-56	57-63

	AMXM(10)	AMXM(11)	AMXM(12)	AMXM(13)
Card 6:	1-7	8-14	15-21	22-28
	AMXM(14)	AMXM(15)		
	29-35	36-42		

The maximum distribution interval designates the range of the distribution. If a value happens to be greater than the maximum, the datum will be placed in the last interval.

Cards 7 & 8 Each histogram also has an interval size associated with it. These values are punched in floating point notation in the form XXXXX.X and are distributed on cards 7 and 8 as follows:

	QNTA(1)	QNTA(2)	QNTA(3)	QNTA(4)	QNTA(5)
Card 7:	1-7	8-14	15-21	22-28	29-35
	QNTA(6)	QNTA(7)	QNTA(8)	QNTA(9)	
	36-42	43-49	50-56	57-63	

	QNTA(10)	QNTA(11)	QNTA(12)	QNTA(13)
Card 8:	1-7	8-14	15-21	22-28
	QNTA(14)	QNTA(15)		
	29-35	36-42		

Card 9 This card contains cut-off data used in histograms 10, 11, 12, and 13. KTARG is the minimum number of targets of interest and SWLD is the minimum sector width of interest. KTARG is a fixed point number and SWLD is a floating point number in the form XX.XXX. Their fields are designated.

Allowing the interval size as an input parameter makes it possible for the analyst to have any spread he desires. However, there can be no more than twenty (20) intervals in each histogram. The computer determines the number of intervals by dividing AMXM by QNTA. It is the analyst's responsibility to assure that the AMXM and QNTA are chosen to give no more than twenty intervals.

On the card as follows:

Card 9:	KTARG	SW1.D
	1-5	6-11

Card 10: Card 10 contains the number of frames in the run. It is specified as a fixed point number in the first 5 columns.

Card 10:	MAXLIM
	1-5

Card 11: Card 11 contains the radar ID's and the range. The ID's are in fixed point notations and the range is in floating point notation in the form XXXXX.X. Their fields are as follows:

Card 11:	JR	KR	LRA	LRB	LRC	RANGE
	1-5	6-10	11-15	16-20	21-25	26-32

The range is designated in miles.

There are three types of data outputted from Section III, on-line data (rates, and histograms of sums), tape 2 data (X and Y coordinates of hits), and tape 6 data (intermediate data).

On-line data are outputted from the computer directly on the tabulator. There are two types of on-line output. (1) Frame by frame and totals outputted after all the frames have been completed. (2) At the end of the run are the histrograms of the totals for the misses and hits and any other histogram specified by the input data. The first two histograms misses and hits, are standardized and outputted below the histograms with an S in the margin. Means and standard deviations are also calculated for these two histograms and are outputted to the right of the histograms.

Tape 2 data are outputted for future use by auxiliary routines.

Tape 6 data are outputted under the control of the IM switches (see input data). This data is used mostly for checking purposes, however, this data may also be used for auxiliary investigations by writing an appropriate input routine.

1.3.2 Glossary

AMXM — Maximum value of histogram intervals. Any data values higher than AMXM are collected in the last interval.

AQT — Temporary floating point storage of interval headings of histograms. LQT is the fixed point storage ID. These two are equivalent.

AVE — Average of data in histograms. Only outputted on IM (1).

BMA — Difference between the upper and lower limits of a strobe sector read in from tape 4 (calculated in Section I).

DATA — Identification index of items being histogrammed.

DEH
DEM — Temporary storage used when calculating the mean and standard deviation for histograms 1 and 2.

DEV — Standard deviation for histograms. Only outputted on IM(1).

DH
DH1
DH2 — Temporary storage used when calculating the mean and standard deviation for histograms 1 and 2.

DISQ — Distance between an apparent target and its nearest true target.

DSJQ — Distance between a true target and its nearest apparent target.

DM, DM1,
DM2 — Temporary storage used when calculating the mean and standard deviation for histograms 1 and 2.

DRT — Ratio of number of apparent target to numbers of true targets in range of 3 radars.

DSCL1
DSCL2
DSCL3 — Distance between true and apparent targets in classes 1, 2 and 3. (Misses, hits and false alarms.)

DTRAT Ratio of number of apparent target to number of true targets.

FAC1, FAC2 Temporary storage used when standardizing histograms 1 and 2.

I A general index used in Do loops.

ICLS1, ICLS2, ICLS3 Temporary indices used to keep track of true targets in classes 1, 2 and 3. (Misses, hits and false alarms.)

ID Run number.

IH A dimensioned index identifying which histograms are being calculated.

IHT Calculated histogram interval into which a given datum falls.

IM Intermediate output selectors. IM(1), IM(2), IM(3), IM(4).

IP Number of apparent target in a frame.

IR Temporary storage of radar ID while reading in strobe information.

IRT An index which keeps track of the number of radars which detected in a giver frame.

ISAVE A dimensioned index storing the number of strobes for a radar.

ISP Number of apparent targets read in from a given block of data.

IX Temporary index used on input for number of strobes from a given radar.

J General index used in Do loops.

JCLS1, JCLS2, JCLS3 Temporary indices used to keep track of apparent targets in classes 1, 2 and 3. (Misses, hits and false alarms.)

J4, J5, JE Temporary index used when setting up histogram data.

JR ID of base radar.

KING Assigned GO TO Constant used to select proper input statement when reading in apparent targets from tape 3.

KLOCK Frame number.

KNT A count of lines of output, used for page restoring.

KO A dump storage for eliminating unwated data on tapes 3 and 4.

KORAN An assigned GO TO constant used to determine whether the histograms for all the radars are done.

KOUNT A count of the number of targets in range for a frame.

KQ A temporary index used in setting up data for the histograms.

KR ID of one of the base radars.

KRO An index used to keep track of which histogram is being calculated.

KRU An assigned GO TO constant used to select histograms "strobe width" and "number of targets per sector."

KSUM Storage for accumulating items such as number of elements in the classes, miss rate, hit rate, etc. KSUM is the fixed point items and RSUM is used for floating point items. The two are equivalent.

KTARG Input constant designating number of target per sector. Used as a lower cut-off. i.e., KTARG = 4 means any sector with less than 4 targets is disregarded in the histogram.

KTLOCK Intermediate storage of frame number used for comparison in reading in data from tapes 3 and 4.

KXC
KXD
KXE Assigned GO TO constants used in selection nearest apparent target to a true target and vice versa.

KXG
KXL
KXP Assigned GO TO constants used in setting up data for histograms.

K1 Temporary index used when setting up histogram data.

L A count of the number of items in class 2 and class 3.

LBJ A temporary constant used to output histograms of all radar data combined.

LH Storage of number of items in the intervals of a histogram.

LQT See AQT.

LRA
LRB
LRC ID of secondary radars.

LSUM Accumulation of items in LH for histograms of all radars.

M A count of the number of items in class 1.

MA, MB Temporary indices used for output.

MAR A dump storage for eliminating data not wanted from tape 4.

MAX Number of intervals in a histogram. Can be from 1 to 20.

MAXLIM Total number of frames in the run. Input data.

ME A temporary index used in sorting targets.

MOP A temporary index used in reading input data from tapes 3 and 4.

MX A temporary constant used to designate which class is being outputted in IM(3).

M1SUM
M2SUM The histograms of classes 1 and 2 are standardized for comparison. M1SUM and M2SUM are the standardizations for LSUM(1) and LSUM(2).

N A variable indicating which histogram is being calculated.

NA Number of targets in a strobe sector calculated in Section I. Inputted from tape 4.

NATI A table identifying the true target closest to a given apparent target and vice versa, for tabling.

NECL1
NECL2
NECL3 Number of elements in class 1, class 2 and class 3.

NFARAT Ratio of number of false alarms to number of apparent targets in a frame.

NG A switching constant used to indicate that all the true or apparent targets have been sorted.

NHTRAT Ratio of the number of hits to the number of apparent targets.

NIL A dump storage for eliminating data not wanted from tape 4.

NMSRAT Ratio of number of misses to the number of real targets.

NO Number of true targets.

NODSTS Number of runs being processed in a given pass.

NR Number of radars.

NTJ A table identifying the apparent target closest to a given true target and vice versa for outputting.

NU A temporary index used in setting up data for histograms.

QNTA The size of an interval in a histogram.

RANGE Maximum distance between a radar and a target for detection.

RSUM See KSUM.

RX X coordinate of a radar.

RY Y coordinate of a radar.

SD Temporary storage used in finding closest true target to an apparent target and vice versa.

SIG1
SIG2 Standard deviation for histograms 1 and 2.

SM1 Floating notation for sum of elements in class 1 for a frame.

SUM Sum of items in a histogram. Used to calculate mean.

SWLD Strobe width in degrees. An input parameter used as a m minimum strobe width when calculating some histograms.

T A strobe from a given radar.

TO1, TO2 Floating notation for number of elements in class 1 and class 2 for a run.

T1, T2 Temporary storage used in sorting true and apparent targets.

X X coordinate of a true target.

XA X coordinate of an apparent target.

XCLK Frame number in floating notation.

XH Temporary storage in calculating mean and standard deviation for histogram of hits.

XID   Run number in floating notation.

XM   Temporary storage in calculating mean and standard deviation for histogram of misses.

Y   Y coordinate of a true target.

YA   Y coordinate of an apparent target.

1.3.3 FORTRAN Listing

```
      DIMENSIONIH(15),AMXM(15),QNTA(15),NSSPD(5),RX(8),RY(8),X( 50),
     XY( 50),BMA(5,100),NA(5,100),ISAVE(5),T(5,100),XA(200),YA(200),
     XDISQ(50),NTJ(50),DJSQ(50),NATI(50),ICLS2(50),JCLS2(50),DCLS2(50),
     XICLS1(50),JCLS1(50),DCLS1(50),ICLS3(50),JCLS3(50),DCLS3(50)
      DIMENSION DATA(125),LH( 25),AQT( 25),LQT( 25),LSUM(15,20),KSUM(15)
     X,RSUM(15)
      DIMENSION M1SUM(20),M2SUM(20)
      EQUIVALENCF (KSUM,RSUM)
      EQUIVALENCE (LQT,AQT)
      READ 1000,NODSTS
 1000 FORMAT(I5)
      REWIND 2
      REWIND 3
      REWIND 4
  422 IF(NODSTS) 90,90,91
   90 REWIND 3
   92 REWIND 4
      END FILE  2
      REWIND 2
      END FILE 5
      REWIND 5
      END FILE 6
      REWIND 6
      PAUSE 1
   91 NODSTS = NODSTS-1
      T01 = 0
      DO 140 I = 1,15
      KSUM(I) = 0
      DO 140 II= 1,20
  140 LSUM (I,II) = 0
      READ 978,IM1,IM2,IM3,IM4
  978 FORMAT(4I5)
C     SPECIFY HISTOGRAM PARAMETFRS
      READ 991 , (IH(I).I = 1,15)
  991 FORMAT (9I7)
```

```
      READ 998, (AMXM(I),I=1,15)
  998 FORMAT (9F7.2)
      READ 992,(QNTA(I),I=1,15)
  992 FORMAT(9F7.1)
      READ 994,KTARG,SWLD
  994 FORMAT(I5,F6.3)
      READ INPUT TAPE 4,1002,ID,NO,NR,MAXLIM
 1002 FORMAT (4I15)
      READ 1000,MAXLIM
      READ 1001 , JR, KR, LRA, LRB, LRC, RANGE
 1001 FORMAT  (5I5,F7.1)
  500 ASSIGN 11 TO KING
      KNT = 0
      IRT=0
      DO 1 I= 1,NR,4
    1 READ INPUT TAPE 4,1006,ID,KLOCK,MX,NIL,RX(I),RY(I),RX(I+1),RY(I+1)
     X,RX(I+2),RY(I+2),RX(I+3),RY(I+3)
 1006 FORMAT(I5,I4,I3,I4,8F8.2)
   13 IF(KNT) 70,71,70
   70 KNT = KNT -1
      GO TO 72
   71 KNT = 49
      PRINT 981,ID,NO
  981 FORMAT(16H1CASE NUMBER     I5,10H.    NT     I5,57H      TRIANGULATION
     X SECTION 3. BENDIX SYSTEMS DIVISION 704)
      PRINT 982
  982 FORMAT(76H CLOCK       K     NMS     NHT     NFS NFARAT NHTRAT NMSRAT
     XNDTRAT     NDR  KOUNT)
   72 MOP = 1
 1008 FORMAT(80H
     X
      DO 2 I=1,NO,4
    2 READ INPUT TAPE 4,1006,ID,KLOCK,MX,MAR,X(I),Y(I),X(I+1),Y(I+1),
     XX(I+2),Y(I+2),X(I+3),Y(I+3)
  986 DO 985 I=1,NR
  985 ISAVE(I)=0
    9 READ INPUT TAPE 4,1039,KO,MX,IR,IX
 1039 FORMAT (I9,I3,I2,I60)
      IF(MX-18) 6,6,4
    6 ISAVE(IR)= IX
      DO 10 I = 1,IX,4
   10 READ INPUT TAPE 4,1008
      DO 7 I=1,IX,4
    7 READ INPUT TAPE 4,1010,ID,KLOCK,MX,KO,BMA(IR,I),NA(IR,I),BMA(IR,I+
     X1),NA(IR,I+1),BMA(IR,I+2),NA(IR,I+2),BMA(IR,I+3),NA(IR,I+3)
 1010 FORMAT(I5,I4,I3,I5,F6.3,I4,F6.3,I4,F6.3,I4,F6.3,I4)
   86 DO 8 I=1,IX,4
    8 READ INPUT TAPE 4,1014,KO,T(IR,I),T(IR,I+1),T(IR,I+2),T(IR,I+3)
 1014 FORMAT(I14,4F10.3)
      GO TO 9
    4 IP = 0
      IF(IX-2)66,66,14
   14 GO TO KING,(11,18)
   66 IF(IX)13,13,68
   68 KRO=6
      GO TO 49
   11 READ INPUT TAPE 3,1008
      READ INPUT TAPE 3,1016,KO,KTLOCK,KO,ISP,KO,KO,KO,KO,KO,KO,KO,KO,KO
     X,KO,KO,KO
 1016 FORMAT (I5,I4,I3,5I5,I7,7I5)
      IF (KTLOCK - KLOCK) 18,18,81
   18 ASSIGN 11 TO KING
      IP = IP + ISP
      READ INPUT TAPE 3,1008
      DO 15 I=MOP,IP,4
   15 READ INPUT TAPE 3, 1018,KO,XA(I),YA(I),XA(I+1),YA(I+1),XA(I+2),YA(
     9I+2),XA(I+3),YA(I+3)
 1018 FORMAT(I16,8F8.2)
      READ INPUT TAPE 3,1008
      MOP=IP +1
      DO 16 I = 1,ISP
   16 READ INPUT TAPE 3,1008
      IF(ISP-24)89,89,19
   19 ASSIGN 18 TO KING
      GO TO 11
   81 ASSIGN 18 TO KING
C     SORTING TRUE AND APPARENTS BY MAGNITUDE OF Y-COORDINATE
   89 KRO = 1
      IF (IP) 66,66,67
   67 ME = NO - 1
   23 NG=0
      DO 24 I=1,ME
      IF(Y(I+1)-Y(I)) 25,24,24
   25 T1=Y(I+1)
      T2=X(I+1)
      Y(I+1)=Y(I)
      X(I+1)=X(I)
      Y(I)=T1
      X(I)=T2
      NG=1
   24 CONTINUE
      IF(NG) 26,26,23
   26 ME=IP-1
      IF (ME) 27,30,27
   27 NG=0
```

```
      DO 28 I=1,ME
      IF(YA(I+1)-YA(I)) 29,28,28
   29 T1=YA(I+1)
      T2= XA(I+1)
      YA(I+1)=YA(I)
      XA(I+1)=XA(I)
      YA(I)=T1
      XA(I)=T2
      NG=1
   28 CONTINUE
      IF(NG) 30,30,27
C     FINDING CLOSEST AT TO TT AND VICE VERSA
   30 MA=NO
      MB=IP
      ASSIGN 33 TO KXC
      ASSIGN 36 TO KXD
      ASSIGN 40 TO KXE
   32 DO 41 I=1,MA
      J=1
      GO TO KXC,(33,34)
   33 DISQ(I) = ((X(I) - XA(J))**2 + (Y(I) - YA(J))**2)**.5
      NTJ(I)=J
      GO TO 35
   34 DJSQ(I) = ((XA(I) - X(J))**2 + (YA(I) - Y(J))**2)**.5
      NATI(I)=J
   35 DO 31 J=2,MB
      GO TO KXD,(36,37)
   36 SD      = ((X(I) - XA(J))**2 + (Y(I) - YA(J))**2)**.5
      IF(SD-DISQ(I)) 38,31,31
   38 DISQ(I)=SD
      NTJ(I)=J
      GO TO 31
   37 SD      = ((XA(I) - X(J))**2 + (YA(I) - Y(J))**2)**.5
      IF(SD-DJSQ(I)) 39,31,31
   39 DJSQ(I)=SD
      NATI(I)=J
   31 CONTINUE
   41 CONTINUE
      GO TO KXE,(40,42)
   40 ASSIGN 34 TO KXC
      ASSIGN 37 TO KXD
      ASSIGN 42 TO KXE
      MA= IP
      MB=NO
      GO TO 32
   42 IF(IM2) 45,700,45
C     INTERMEDIATE OF TABLES BEFORE CLASSIFICATION
```

```
  700 WRITE OUTPUT TAPE 6,702,NO,ID,KLOCK
  702 FORMAT(55H    X        XA         Y        YA      DIST      I    J NOTRT=
     9I4,I5,I5)
      DO 704 I=1,NO
      MB=NTJ(I)
  704 WRITE OUTPUT TAPE 6,703,(X(I)),(XA(MB)),(Y(I)),(YA(MB)),DISQ(I),
     9I,MB
  703 FORMAT(5F8.3,2I4)
      WRITE OUTPUT TAPE 6,712,IP
  712 FORMAT(55H   XA        X       YA        Y       DIST      J    I NOAPT=
     XI4)
      DO 705 I=1,IP
      MB=NATI(I)
  705 WRITE OUTPUT TAPE 6,703,(XA(I)),(X(MB)),(YA(I)),(Y(MB)),DJSQ(I),
     9I,MB
   45 L=0
      M=0
C     CLASS II CONTENTS
      DO 43 I=1,NO
      MC=NTJ(I)
      IF(NATI(MC)-I) 46,47,46
   47 NATI(MC)=-1
      L=L+1
      ICLS2(L)=I
      JCLS2(L)=MC
      DCLS2(L)=DISQ(I)
      GO TO 43
C     CLASS I CONTENTS
   46 M=M+1
      ICLS1(M)=I
      JCLS1(M)=MC
      DCLS1(M)=DISQ(I)
   43 CONTINUE
      NECL1=M
      NECL2=L
C     CLASS III CONTENTS
      L=0
      DCLS3(1)=0
      JCLS3(1) = 0
      ICLS3(1) = 0
      DO 44 I=1,IP
      IF(NATI(I)) 44,44,48
   48 L=L+1
      DCLS3(L)=DJSQ(I)
      JCLS3(L)=I
      ICLS3(L)=NATI(I)
   44 CONTINUE
      NECL3=L
      XID = ID
      XCLK = KLOCK
      DO 141  I = 1,NECL2
      MB = JCLS2(I)
      MA=ICLS2(I)
  141 WRITE OUTPUT TAPE 2,989,KLOCK,XID,XCLK,MA,MB,DCLS2(I),X(MA),Y(MA),
     XXA(MB),YA(MB)
  989 FORMAT (I5,F10.7,F5.0,2I8,5F8.2)
      IF(IM3)49,701,49
C     INTERMEDIATE OF CLASSES
  701 MX=1
      ASSIGN 711 TO KXC
  706 WRITE OUTPUT TAPE 6,707,MX
  707 FORMAT(  4H CLSI2,48H     X        XA         Y        YA      DIST      I
     X  J)
      GO TO KXC,(711,713,715)
  711 DO 708 I=1,NECL1
      MA=ICLS1(I)
      MB=JCLS1(I)
  708 WRITE OUTPUT TAPE 6,709,(X(MA)),(XA(MB)),(Y(MA)),(YA(MB)),DCLS1(I)
     X,MA,MB
  709 FORMAT(F12.3,4F8.3,2I4)
      MX=2
      ASSIGN 713 TO KXC
      GO TO 706
  713 DO 710 I=1,NECL2
      MA=ICLS2(I)
      MB=JCLS2(I)
  710 WRITE OUTPUT TAPE 6,709,(X(MA)),(XA(MB)),(Y(MA)),(YA(MB)),DCLS2(I)
     6,MA,MB
      MX=3
      ASSIGN 715 TO KXC
      GO TO 706
  715 IF (NECL3)  49,49,716
  716 DO 714 I=1,NECL3
      MB=JCLS3(I)
      MA= ICLS3(I)
  714 WRITE OUTPUT TAPE 6,709,(X(MA)),(XA(MB)),(Y(MA)),(YA(MB)),DCLS3(I)
     8,MB,MA
C     COMPUTE HISTOGRAMS
   49 N=KRO
  296 FORMAT(1H1)
  505 IF (IH(N)) 99,345,99
  345 GO TO (51,52,53,54,55,56,57,58,59,60,61,62,63,64,65 ),N
   51 MX=1
      NU=NECL1
      DO 121 I=1,NU
```

```
121 DATA(I)=DCLS1(I)
125 MAX = (AMXM(N)/QNTA(N))   + 1
    ASSIGN 99 TO KORAN
    GO TO 100
 52 MX=2
    NU= NECL2
    DO 123 I=1,NU
123 DATA(I)= DCLS2(I)
    GO TO 125
 53 MX=3
    NU=NECL3
    DO 119 I=1, NU
119 DATA(I)=DCLS3(I)
    GO TO 125
 54 MX=4
    NU=NO
    DO 127 I=1,NU
127 DATA(I)=DISQ(I)
    GO TO 125
 55 MX=5
    NU=IP
    DO 129 I=1,NU
129 DATA(I)=DJSQ(I)
    GO TO 125
 56 ASSIGN 860 TO KXP
193 ASSIGN 861 TO KORAN
861 IRT=IRT+1
    IF(IRT-NR) 131,131,133
131 IF(ISAVE(IRT)) 861,861,380
380 NU=ISAVE(IRT)
    DO 132 I=1,NU
    GO TO KXP,(860,166)
860 DATA(I)= BMA(IRT,I)*57.2957795
    GO TO 132
166 DATA(I)=FLOATF(NA(IRT,I))
132 CONTINUE
862 MAX = (AMXM(N)/QNTA(N))   + 1 .
    GO TO 100
133 IRT=0
    GO TO 99
 57 ASSIGN 863 TO KRU
168 NU=0
    DO 135 I=1,NR
135 NU=NU+ISAVE(I)
    KQ=1
    K1=0
    DO 136 I=1,NR
    IF(ISAVE(I)) 136,136,381
```

```
381 ME=ISAVE(I)+K1
    J4=0
    DO 137 II= KQ,ME
    J4=J4+1
    GO TO KRU,(863,167)
863 DATA(II)= BMA(I,J4) * 57.2957795
    GO TO  137
167 DATA(II) = FLOATF(NA(I,J4))
137 CONTINUE
    KQ=ME+1
    K1=ISAVE(I)
136 CONTINUE
    GO TO 125
 58 ASSIGN 166 TO KXP
    GO TO 193
 59 ASSIGN 167 TO KRU
    GO TO 168
 60 ASSIGN 182 TO KXG
183 ASSIGN 172 TO KORAN
172 IRT=IRT+1
    IF(IRT-NR) 170,170,133
170 IF(ISAVE(IRT)) 172,172,383
383 NU=ISAVE(IRT)
    JE=0
    DO 171 I=1,NU
    GO TO KXG,(182,181)
182 IF(NA(IRT,I)-KTARG) 171,173,173
173 JE=JF+1
    DATA(JE)=BMA(IRT,I)*57.2957795
    GO TO 171
181 IF(BMA(IRT,I)-SWLD) 171,184,184
184 JE=JE+1
    DATA(JE)=FLOATF(NA(IRT,I))
    GO TO 171
171 CONTINUE
397 NU=JE
    MAX = (AMXM(N)/QNTA(N))  + 1 .
    GO TO 100
 61 ASSIGN 177 TO KXL
175 KQ=1
    K1=0
    J4=0
    DO 176 I=1,NR
    IF(ISAVE(I)) 176,176,384
384 ME=ISAVE(I)+K1
    J5=0
    DO 179 II=KQ,ME
    J5=J5+1
```

```
      GO TO KXL,(177,187)
  177 IF(NA(I,J5)-KTARG) 179,178,178
  178 J4=J4+1
      DATA(J4)=BMA(I,J5)*57.2957795
      GO TO 179
  187 IF(BMA(I,J5)-SWLD) 179,188,188
  188 J4=J4+1
      DATA(J4)=FLOATF(NA(I,J5))
  179 CONTINUE
      KQ=ME+1
      K1=ISAVE(I)+K1
  176 CONTINUE
      NU=J4
      GO TO 125
   62 ASSIGN 181 TO KXL
      GO TO 183
   63 ASSIGN 187 TO KXL
      GO TO 175
   64 ASSIGN 99 TO KORAN
      GO TO 164
   65 NU=0
      DO 208 I=1,NR
  208 NU=ISAVE(I)+NU
      ASSIGN 99 TO KORAN
      GO TO 165
C     COMPUTE HISTOGRAMS
  100 DO 110 I= 1,20
      AQT(I) = 0
  110 LH(I)=0
      IF.(DATA(1))301,300,301
  301 DO 111I=1,NU
      IHT = (DATA(I)/QNTA(N)) + 1
      IF (IHT - MAX) 112,113,113
  113 IHT = MAX - 1
  112 LH(IHT)=LH(IHT)+1
  111 LSUM(N,IHT) = LSUM(N,IHT) + 1
      IF(IM1) 300,116,300
  116 SUM = 0
      DO 114 I=1,NU
  114 SUM=SUM+DATA(I)
      AVE=SUM/FLOATF(NU)
      SUM=0.
      DO 115 I=1,NU
  115 SUM=SUM+(DATA(I)-AVE)**2
      DEV=SQRTF(SUM/FLOATF(NU))
      GO TO(151,151,151,151,151,156,157,158,159,160,161,162,163,164,165)
     X,N
  151 WRITE OUTPUT TAPE 6,251,MX
  251 FORMAT(31H HISTOGRAM OF ELEMENTS OF CLASSI2)
      GO TO 290
  156 WRITE OUTPUT TAPE 6,256,IRT
  256 FORMAT(43H HISTOGRAM OF STROBE WIDTH IN DEGREES/RADARI2,6H/FRAME)
      GO TO 290
  157 LBJ=6
      WRITE OUTPUT TAPE 6,256,LBJ
      GO TO 290
  158 WRITE OUTPUT TAPE 6,258,IRT
  258 FORMAT(44H HISTOGRAM OF NUMBER OF TARGETS/SECTOR/RADARI2,6H/FRAME)
      GO TO 290
  159 LBJ=6
      WRITE OUTPUT TAPE 6,258,LBJ
      GO TO 290
  160 WRITE OUTPUT TAPE 6,260,KTARG,IRT
  260 FORMAT(33H HISTOGRAM OF NO. OF SECTORS WITHI3,22H OR MORE TARGETS/
     XRADARI2,6H/FRAME)
      GO TO 290
  161 LBJ=6
      WRITE OUTPUT TAPE 6,260,KTARG,LBJ
      GO TO 290
  162 WRITE OUTPUT TAPE 6,262,SWLD,IRT
  262 FORMAT(44H HISTOGRAM OF NO. OF TARGETS/SECTOR OF WIDTHF7.2,14H OR
     XMORE/RADARI2,6H/FRAME)
      GO TO 290
  163 LBJ=6
      WRITE OUTPUT TAPE 6,262,SWLD,LBJ
      GO TO 290
  164 DO 263 I=1,NR
  263 WRITE OUTPUT TAPE 6,264,I,(ISAVE(I))
  264 FORMAT(25H NO. OF ENTRIES FOR RADARI2,3H ISI3)
      GO TO 300
  165 WRITE OUTPUT TAPE 6,265,NU
  265 FORMAT(39H TOTAL NO. OF ENTRIES FOR ALL RADARS ISI4)
      GO TO 300
  290 MX=30+N
      WRITE OUTPUT TAPE 6,289
  289 FORMAT(44H  RUN CLK TT    MAX    QNTA   MEAN   STD DEV)
      WRITE OUTPUT TAPE 6,293,ID,KLOCK,MX,MAX,QNTA(N),AVE,DEV
  293 FORMAT(I5,I4,I3,I7,F7.1,2F8.2)
      DO 411 I=1,MAX
      AQT(I+1)=AQT(I)+QNTA(N)
  411 LQT(I) = AQT(I)
      WRITE OUTPUT TAPE 6,295,(LQT(I+1),I=1,20)
      WRITE OUTPUT TAPE 6,295,(LH(I),I=1,20)
  295 FORMAT(20I4)
  300 GO TO KORAN,(99,861,172)
   99 IF(N-15)410,423,423
```

```
410 N=N+1
    GO TO 505
423 IRT=0
    KOUNT=0
    DO 450 I=1,NO
    IF(((X(I)-RX(JR))**2+(Y(I)-RY(JR))**2)**.5-RANGE)451,451,450
451 IF(((X(I)-RX(KR))**2+(Y(I)-RY(KR))**2)**.5-RANGE)452,452,450
452 IF (((X(I)-RX(LRA))**2+(Y(I)-RY(LRA))**2)**.5-RANGE) 453,453,454
454 IF(LRB) 455,450,455
455 IF((( X(I)-RX(LRB))**2+ (Y(I)-RY(LRB))**2)**.5-RANGE)453,453,456
456 IF (LRC) 457, 450, 457
457 IF (((X(I)-RX(LRC))**2+(Y(I)-RY(LRC))**2)**.5-RANGE) 453, 453,450
453 KOUNT=KOUNT+1
450 CONTINUE
    DTRAT = FLOATF ;(IP*1000)/NO)
    NMSRAT = (NECL1*1000)/NO
    NHTRAT =  (NECL2*1000)/IP
    NFARAT = (NECL3*1000)/IP
    DRT = FLOATF((IP*1000)/KOUNT)
    SMI=NECL1
    TO1=TO1+SMI
    IF(NECL1) 433,434,433
434 IF(KOUNT) 435,433,435
435 IF(NECL2) 433,436,433
436 NECL1 = NO
433 PRINT 983,KLOCK,IP,NECL1,NECL2,NECL3,NFARAT,NHTRAT,
   XNMSRAT,DTRAT,DRT,KOUNT
983 FORMAT (I6,7I7,2F7.0,I7)
    KSUM(1) = KSUM(1) + IP
    KSUM(2) = KSUM(2) + NECL1
    KSUM(3) = KSUM(3) + NECL2
    KSUM(4) = KSUM(4) + NECL3
    KSUM(5) = KSUM(5) + NFARAT
    KSUM(6) = KSUM(6) + NHTRAT
    KSUM(7) = KSUM(7) + NMSRAT
    RSUM(8) = RSUM(8) + DTRAT
    RSUM(9) = RSUM(9) + DRT
    KSUM(10)= KSUM(10)+ KOUNT
    RSUM(11) = RSUM(11) + (DRT**2.)
    NECL1 = 0
    NECL2 = 0
    NECL3 = 0
    IF(KLOCK-MAXLIM) 13,421,421
421 RSUM(8) = RSUM(8)/1000.
    RSUM(9) = RSUM(9)/1000.
    RSUM(11) = RSUM(11)/1000000.
    PRINT 995,(KSUM(I),I = 1,11)
995 FORMAT(6H0SUMS  7I7,2F7.3,I7,F10.6,14H = SUM SQS NDR)
```

```
      PRINT 981, ID, NO
      PRINT  921
  921 FORMAT  (37H0   FREQUENCY OF OCCURENCE HISTOGRAMS)
      PRINT  922
  922 FORMAT(104H HIST.      1   2   3   4   5   6   7   8   9  10  11  1
     X2  13  14  15  16  17  18  19  20     SIGMA   MEAN)
      TO2 = KSUM(3)
      DH1 = 0
      DM1 = 0
      DH = 0
      DM = 0
      DH2 = 0
      DM2 = 0
      DEH = QNTA(2)*.5
      DEM=QNTA(1)*.5
      DO 416 M = 1,20
      DH = FLOATF(LSUM(2,M))*DEH
      DH1 = (DH * DEH) + DH1
      DH2 = DH2 + DH
      DM = FLOATF (LSUM(1,M)) * DEM
      DM1 = (DM * DEM) + DM1
      DM2 = DM2 + DM
      DEH = DEH + QNTA(2)
  416 DEM = DEM + QNTA(1)
      XM = DM2/TO1
      SIG1 = ((DM1/TO1) - (XM**2.))**.5
      XH = DH2/TO2
      SIG2 =((DH1/TO2) - (XH**2.))**.5
      FAC1 = 1000./TO1
      FAC2 = 1000./TO2
      DO 417 M = 1,20
      M1SUM(M) = (FAC1*FLOATF(LSUM(1,M))) + .5
  417 M2SUM(M) = (FAC2*FLOATF(LSUM(2,M))) + .5
      PRINT 970, (LSUM(1,II),II = 1,20),SIG1,XM
  970 FORMAT (4H0  1 I8,19I4,F10.3,F9.3)
      PRINT 971, (M1SUM(I),I = 1,20)
  971 FORMAT (4H S 1 I8,19I4)
      PRINT 972, (LSUM(2,II),II = 1,20),SIG2,XH
  972 FORMAT (4H0  2 I8,19I4,F10.3,F9.3)
      PRINT 973, (M2SUM(I),I = 1,20)
  973 FORMAT (4H S 2 I8,19I4)
      I = 3
  427 IF(IH(I)) 428,424,428
  424 PRINT 297,I,(LSUM(I,II),II = 1,20)
  297 FORMAT (1H0 I4,I8,19I4)
  428 I = I+1
      IF(I - 15) 427,427,422
      END (0,1,1,0,1)
```

SECTION 2

FORTRAN PROGRAM FOR SIMULATION OF THE CORRELATION SYSTEM

The complete system simulation program has evolved from the initial model with additional modifications. These modifications include an environment generator for maneuvering targets, a modification to accept the new environment generator, modification to obtain miss-distance, and a modification for raid size estimate.

The original program and its modifications are described in the following five sections. The sixth section is a description of the off-line historical data analysis program. Each of these sections give a glossary of terms, FORTRAN listing, and flow charts.

Input to the simulation program is made by cards only. For each individual case, there are three input cards plus one for each target in the raid.

1. CARD 1

K1, K2, K3, K4, K5, K6, K7, K8, K9, K0 These inputs are used to control the optional output. An integer causes output, while a zero will bypass output. The outputs associated with each "switch" are listed below.

K1 — the frequency distribution of target clusters

K2 — no longer in use

K3 — the X and Y coordinates of all targets (true and apparent)

K4 — no longer in use

K5 — no longer in use

K6 — if the number of the true targets scored as "misses", the number of the nearest apparent target and the distance between them

K7 — the target numbers of targets in a "hit" pair and the distance between them, along with the locations of these targets

K8 — the number of the apparent targets scored as "false alarms", number of the nearest true, and the distance b tween

K9 — no longer in use

K0 — the frequency distribution of the signal-to-noise ratio

2. CARD 2

NT, CLOCKS, CLOCKL, CASE, AZNUL, DELNUL

NT — the number of targets in the raid

CLOCKS — the frame number at which the simulation is to begin calculation

CLOCKL — the last frame the simulation is to evaluate

CASE — the case number (used for identification)

AZMUL — a parameter which controls the range of the azimuth uncertainity

DELMUL — a parameter which controls the range of the delta uncertainity

3. CARD 3

RMAX, RMIN, RMIN2, AZRES, DELRES

RMAX — the maximum range at which the radar can detect a target (horizon cut-off)

RMIN — the range at which the noise level is no longer a function range

AZRES – this is related to the azimuth resolution capabilities of the radar. If the difference in azimuth of two or more, targets is less than this parameter, the targets are not resolved in azimuth

DELRES – this is related to the delta re⁽olution capabilities of the radar. If the difference in delta of two, or more, targets are less than this parameter, the targets are not resolved in azimuth (delta is the difference in path length between target-omni and target-search radar)

4. CARD 4

X(I), Y(I), DELX(I), DELY(I)

X(I) – the X coordinate of the target

Y(I) – the Y coordinate of the target

DELX(I) – the distance the target will travel in a direction parallel to the X axis in a single frame

DELY(I) – the distance the target will travel in a direction parallei to Y axis is a single frame

There are NT CARD 4's per case. There must be one for each target in the raid. To run successive cases, all four types of cards must be repeated for each case.

Through-out the simulation, frequency distributions are generated and stored. They are part of the optional and/or normal output as follows:

Normal Program Output

1. Per Frame (printed-on-line, one line per frame)

   a. Frame number

   b. Number of apparent targets (number of detections) in the frame

   c. Number of targets in Sector 1

d. Number of targets in Sector 2

e. Number of targets behind the radar

f. Number of "misses"

g. Number of "hits"

h. Number of "false alarms"

i. False alarm rate (number of "false alarms" divided by the number of detections)

j. Hit rate (number of "hits" divided by the number of true targets)

k. Miss rate (number of "misses" divided by the number of true targets)

l. Detection ratio (number of detections divided by the number of true targets)

m. Number of azimuth unresolved clusters

n. Total number of targets involved in azimuth and delta unresolved clusters during this frame

o. Number of azimuth unresolved clusters that are completely resolved in delta

p. Number of targets detected

q. An indicator of the performance of the random number generator (a computed theoretical number of detections)

r. The number of targets that are jammed (how often is the noise too great for the signal to "heard")

s. Number of targets detected divided by number of targets in-range

2. Per Case (Printed on-line)

   a. Summations of items 2, 3, 4, 5, 6, 7, 8, 14, 15, and 19

   b. Frequency distribution of miss distance between hit pairs, and miss distances that are associated with miss pairs (two (2) separate distributions)

Optional Program Output

1. Per Frame

   a. The X, Y coordinates of all true and apparent targets

   b. The target number of the true targets scored as "misses", the number of the nearest apparent target and the distance between them

   c. The target number of targets in a "hit" pair and the distance between them, along with the locations of those targets

   d. The number of the apparent targets scored as "false alarms", the number of the nearest true target, and the distance between them

2. Per Case

   a. Frequency distribution of signal-to-noise ratio

   b. Frequency distribution of all clusters encountered

Most of the optional frame output is on magnetic tape. Each output is independent and any combination may be obtained. The frequency distributions are listed on the on-line printer and are not on tape.

2. 1 ORIGINAL PROGRAM

2. 1. 1 Glossary

2.1.1.1 Subscripted Terms

AZ Azimuth of the target, measured clockwise, at the search radar from west

DELX The X increment. The distance the target will travel in a direction parallel to the X axis in a single frame

DELY The Y increment. The distance the target will travel in a direction parallel to the Y axis in a single frame

DIFX The initial X coordinate minus 500

DIFY The initial Y coordinate minus 500

DISFS The distance in nautical miles between the true and apparent target in a "false alarm" pair

DISH The number of "hits" in a given hit distance interval of the frequency distribution

DISHT The distance in nautical miles between the true and apparent targets in a "hit" pair

DISMS The distance in nautical miles between the true and apparent targets in a "miss" pair

DIST The number of misses in a given miss distance interval of the frequency distribution of "miss" pairs

LAZ The target number of the J^{th} target in an azimuth unresolved list

LAZDEL The target number in an azimuth-delta unresolved list

LASDEX The number of targets in an azimuth-delta unresolved cluster

LJTH The number of the target in an azimuth unresolved cluster, from which the targets are not resolved. Tne "target of interest"

LJTHX The number of targets in a given cluster. Used for the frequency distribution of clusters

LTOT The number of targets left in the final cluster after all delta resolved targets have been removed and all targets not azimuth-delta resolved from the azimuth-delta unresolved cluster are added

LTOTX The same as LTOT except that this is the summation over the entire run. Used for frequency distribution

M The dummy location used to store the sector number of the target and other information

NFSA The target number of the apparent target in a "false alarm" pair

NFST The target number of the true target in a "false alarm" pair

NHTA The target number of the apparent target in a "hit" pair

NHTT The target number of the true target in a "hit" pair

NMSA The target number of the apparent target in a "miss" pair

NMST The target number of the true target in a "miss" pair

NRESOL The list of true target numbers of the unresolved targets

NSIGNO An interval of the signal to noise ratio in the signal to noise frequency distribution

NTTOAA The number of the apparent target closest to a given true

R1	Range from the target to omni 1
R2	Range from the target to omni 2
RO	Range from the target to the search radar
X	The X coordinate of the true target
XAP	The X coordinate of the apparent target
Y	The Y coordinate of the true target
YAP	The Y coordinate of the apparent target

2.1.1.2 Non-Subscripted Variables

ADELTA	The difference in ranges from radar and from omni to jammer (used only in delta unresolved clusters)
AKI	The sum of the squares of NDR
AK9	The sum of NDR's
AMB	The sum of the weighting factor times the noise of the target of all targets in an azimuth unresolved cluster
AMBL	The same as AMB except the noise has minimum restrictions placed on it
ANDR	The same as NDR except it is in floating point. The number of detections divided by the number of targets in range
AND2	ANDR squared
ANGLE	The angle of the apparent target in polar coordinates
ANO	A random number multiplied by AZMUL

AOSIGA Noise to Signal ratio at the omni receiver

AOSIGO Noise to Signal ratio at the search radar

AZMUL Scales the magnitude of the uncertainty in the azimuth of the apparent target

AZRES The azimuth limits which two or more targets must be within to be clarified as azimuth unresolved

A2T The azimuth of the target. Different reference than AZ

BARH The mean distance between "hit" pairs. This is for the entire run

BARM The mean distance between "miss" pairs. This is for the entire run

BNO A random number multiplied by DELMUL

CASE An arbitrary number assigned for identification of input parameters

CLOCK The number of the frame which is being evaluated

CLOCKL The last frame that the simulation is to evaluate

CLOCKS The frame number with which the simulation is to begin

CONV Conversion factor to change radians to degrees

DELMUL Constant used to fix the magnitude of the delta uncertainty for an apparent target

DELRES The delta limits which two or more targets must be within to be classified as delta unresolved

DELTA The difference in ranges from jammer to search radar, and from jammer to omni receiver

DIFRX The difference in the true X and the apparent X coordinate

DIFRY The difference in the true Y and the apparent Y coordinate

DISSQ Shortest distance squared between a true target and an apparent target. Used in scoring only

DISTA Squared root of DISSQ

DIXH Summation of "hits" that occur in the run

DIXM Summation of "misses" that occur in the run

FLJ A weighting factor which gives more weight to the targets closest to the J^{th} target and less weight to those near the edge of the beam (used for azimuth unresolved clusters only)

FRACT The reciprocal of the range squared of the target in an azimuth unresolved cluster

FRE1 Summation of "hits" in a given interval times the midpoint of that interval

FRE2 Summation of "misses" in a given interval times the midpoint of that interval

FRED Midpoint of the interval (upper limit — lower limit) /2; this is for "miss" intervals

FRED2 Summation of "misses" in a given interval times the midpoint of that interval, the quantity squared

FREQ Midpoint of "hit" interval

FREQ2 Same as FRED2 only it applied to "hits"

GAIN Gain in side lobes divided by the gain in the search radar

HIG, HIGH, HIGHR Arbitrary upper limits for frequency distributions

IAP, ID, IND, I, IJ, ITR These are general index registers

J The index register that controls the number of the target of interest

K The number of apparent targets in a given frame

KABAS An index used to denote an unresolved target

KEN Output type number. Used on output tape 3 for identification

K0, K1, K2, K3, K4, K5, K6, K7, K8, K9 (see detailed write-up) Used to control optional output

KK Summation of apparent targets taken over the entire run

KK2 Summation of NSUMM1 for run (targets in sector 1)

KK3 Summation of NSUMM2 for run (targets in sector 2)

KK4 Summation of "missed" targets for run

KK5 Summation of "hit" targets for run

KK6 Summation of "false alarms" for run

KK7 Summation of KOUNT7 for run

KK8 Summation of KOUNT8 for run

KLOO Index register used for targets in a delta unresolved cluster

KNTSUM An indicator of the performance of the random number generator. Should agree closely with KOUNT5

KOUNT1 The number of targets whose probability of detection is unity

KOUNT2 The number of targets whose probability of detection is 0. 6

KOUNT3 The number of targets whose probability of detection is 0. 2

KOUNT4 Number of targets whose probability of detection is zero

KOUNT5 Number of targets detected (equal to K)

KOUNT6 Number of azimuth unresolved clusters

KOUNT7 Total number of targets that are not azimuth or delta resolved

KOUNT8 The number of azimuth unresolved clusters that are resolved in delta

KOUNT9 The number of times that the jammers succeed in completely jamming the search radar (not just denying range information)

L Number of targets in a given azimuth unresolved cluster

LINDX Same as L

LL1 Summation of the LJTHX's

LL2 Summation of the LAZDEX's

LL3 Summation of the LTOTX's

LXX Standardized occurrence of "hits" in hit frequency distribution

LYY Standardized occurrence of "misses" in miss frequency distribution

MDS Equal to DISMS(NMS) /5; this is the index used to compute the miss frequency distribution

MHS Equal to DISHT(NHT) /4; this is the index used to compute the hit frequency distribution

NATOTT Number of the true target that is nearest to a given apparent target (used as an index)

NDR Detection ratio; the number of detections divided by the number of targets in-range (in tenths of percent)

NDTRAT The number of detections divided by the total number of targets in raid (in tenths of percent)

NEEL Number of targets in an azimuth-delta unresolved cluster

NFARAT Number of "false alarms" divided by the number of targets detected (in tenths of percent)

NFS Number of "false alarms" in a frame

NHTRAT Number of "hits" divided by the number of detections (in tenths of percent)

NHT The number of "hits" in a given frame

NMSRAT The number of "misses" divided by the total number of targets in the raid (in tenths of percent)

NMS Number of "misses" in a given frame

NS Equal to signal-to-noise ratio divided by 500; used as the index register in computing signal to noise frequency distribution

NSUMM1 Number of targets in Sector 1 during a given frame

NSUMM2 Number of targets in Sector 2 during a given frame

NSUMM3 Number of targets behind the radar during a given frame

NT The number of true targets taking part in the raid

O A dummy symbolic address used to initialize the random number generator

RADOMA The summation of the reciprocal of the range squared, when RO(I) < RMIN, RO(I) is replaced by RMIN

RANGE The distance from the apparent target to the search radar

RMAX Maximum range at which the radar can "see" a target (horizon cut-off)

RMIN The distance at which noise from jammer is no longer a function of distance

RMIN2 The reciprocal of RMIN squared

SIGMAH Sigma of the "hits" or the standard deviation of the distance between hit pairs

SIGMAN Sigma of the "misses" or the standard deviation of the distance between miss pairs

SIGNO Signal to noise ratic

SUM Summation of the number of "hits"

SUML1 The summation of the reciprocal of the squares of the ranges from omni one to target; if R1(i)< RMIN, RMIN replaces R1(i) (this is the noise at omni 1)

SUML2 The summation of the reciprocal of the squares of the ranges from omni 2 to the target if R2(I)< RMIN, RMIN replaces R2(I)

SUMLO Same as SUMO but with minimum restrictions

SUMO The summation of the reciprocal of the squares of the ranges from the search radar to target (no minimum restriction)

TARGML The signal of the target of interest (equal to FRACT)

TDIFRX Temporary storage for the distance between the X coordinate of the true target and the X coordinate of the apparent (used in the scoring process only)

TDIFRY Same as TDIFRX only it is the difference in Y

X1 X coordinate of omni 1

X2 X coordinate of omni 2

XAPP X coordinate of the apparent target

XLOW, XLO, XHIG, XLOWR Interval limits for frequency distribution

XO X coordinate of search radar

XTRU X coordinate of a true target while simulation is testing for nearest apparent

XX Counter used for controlling output; whenever XX is larger than 50, the program will restore the page on the online printer

Y1 Y coordinate of omni 1

Y2 Y coordinate of omni 2

YAPP Y coordinate of apparent target

YO Y coordinate of search radar

YTRU Y coordinate of true target used while testing for nearest apparent

2. 1. 2 FORTRAN Listing

```
      DIMENSION LJTHX(50),LTOTX(50),LAZDEX(50),NSIGNO(150)
      DIMENSION NTIOAA(100),DISTT(100),NMST(100),NMSA(100),DISMS(100),
     1NHTT(100),NHTA(100),DISHT(100),NFST(100),NFSA(100),DISFS(100)
      DIMENSION DIST(31),DISH(31)
      DIMENSION DIFX(100),DIFY(100)
      DIMENSION X(100),Y(100),DELX(100),DELY(100),M(100),RO(100),K1(100)
     1,K2(100),AZ(100)
      DIMENSION NRESOL(100),LJTH(50),LAZ(50),XAP(100),YAP(100),LAZDEL(50
     1),LTOT(50)
      READ 400,X1,Y1,X2,Y2,GAIN
      READ 400,SIG1,SIG2,SIG3,CON1,CON2
 1500 DO 5333 I=1,50
      LTOTX(I)=0
 5333 LAZDEX(I)=0
      SUX=0.
      SUM=0.
      FRE1=0.
      FRE2=0.
      FRED=0.
      FREQ=0.
      FRED2=0.
      FREQ2=0.
      DXH=0.
      DXM=0.
      PRINT 845
      DO  8050 I =1,31
      DISH(I)=0.
8050  DIST(I)=0.
 5002 FORMAT(90H                                          TLQ 8 PROGRAM
     XDATA. BENDIX SYSTEMS DIVISION 704.)
      DO 5334 I=1,50
5334  LJTHX(I)=0
      DO 8000 I=1,153
8000  NSIGNO(I)=0
      O=0.
      READ 350,K1,K2,K3,K4,K5,K6,K7,K8,K9,K0
350    FORMAT(10I1)
      READ 3,NT,CLOCKS,CLOCKL,CASE,AZMUL,DELMUL
       XX=CLOCKS
3     FORMAT(I5,5F10.1)
      READ 400,RMAX,RMIN,RMIN2,AZRES,DELRES
      PRINT 5002
      PRINT 700,CASE,NT
700    FORMAT(12H CASE NUMBERF8.0,4H  NTI4)
      PRINT 1100,CLOCKS,CLOCKL,AZMUL,DELMUL
 1100 FORMAT(16H          CLOCKSF4.0,7H CLOCKLF6.0,6H AZMULF8.6,7H DELMU
     1LF8.6)
      PRINT 1101,RMAX,RMIN,RMIN2,AZRES,DELRES
 1101 FORMAT((14H           RMAXF6.0,5H RMINF6.0,6H RMIN2F8.7,6H AZRESF8.
     17,7H DELRESF8.6)//)
      PRINT 701
701   FORMAT((118H CLOCK   K NSUMM1 NSUMM2 NSUMM3 NMS NHT NFS NFARAT NHT
     1RAT NMSRAT NDTRAT KOUNT6 KOUNT7 KQUNT8 KOUNT5 KNTSUM  KOUNT9 NDR
     2 )//)
400    FORMAT(5F10.2)
      READ 4,((X(I),Y(I),DELX(I),DELY(I)),I=1,NT)
4     FORMAT(4F10.2)
      CONV=57.29577
      XO=500.
      YO=500.
      KK=0
      KK1=0
      KK2=0
      KK3=0
      KK4=0
      KK5=0
      KK6=0
      KK7=0
      KK8=0
      AK9=0.
      AK1=0.
      CLOCK=CLOCKS
       IF(CLOCKS) 5,7,5
```

```
5       DO 6 I=1,NT
        X(I;=X(I)+CLOCKS*DEL X(I)
6       Y(I)=Y(I)+CLOCKS*DEL Y(I)
7       KOUNT1=0
        KOUNT2=0
        KOUNT3=0
        KOUNT4=0
        KOUNT5=0
        KOUNT6=0
        KOUNT7=0
        KOUNT8=0
        KOUNT9=0
        NSUMM1=0
        NSUMM2=0
        NSUMM3=0
        SUMLO=0.
        SUMO =0.
        SUML1=0.
        SUML2=0.
        DO 50 I=1,NT
        DIFX(I)=X(I)-XO
        DIFY(I)=Y(I)-YO
        RO(I)=SQRTF(DIFX(I)**2+DIFY(I)**2)
        IF(RO(I)-RMAX) 9,9,8
9       IF(RO(I)-RMIN) 500,500,501
500     SUMLO=SUMLO+RMIN2
        GO TO 502
501       SUMLO=SUMLO+1./RO(I)**2
502      SUMO=SUMO+1./RO(I)**2
8       R1(I)=SQRTF((X(I)-X1)**2+(Y(I)-Y1)**2)
        IF(R1(I)-RMAX) 11,11,650
11      IF(R1(I)-RMIN) 652,651,651
651     SUML1=SUML1+1./R1(I)**2
        GO TO 650
652      SUML1=SUML1+RMIN2
650     CONTINUE
13      R2(I)=SQRTF((X(I)-X2)**2+(Y(I)-Y2)**2)
        IF(R2(I)-RMAX) 15,15,660
15      IF(R2(I)-RMIN) 662,661,661
661     SUML2=SUML2+1./R2(I)**2
        GO TO 660
662     SUML2=SUML2+RMIN2
660     CONTINUE
        IF(DIFY(I)) 18,18,19
18      M(I)=3
        NSUMM3=NSUMM3+1
        GO TO 50
```

```
19      IF(RO(I)-RMAX) 40,40,22
 40     IF(DIFX(I))20,23,23
20      IF(R1(I)-RMAX) 21,21,22
22      M(I)=4
        GO TO 50
21      M(I)=1
        NSUMM1=NSUMM1+1
        GO TO 26
23      IF(R2(I)-RMAX) 25,25,22
25      M(I)=2
        NSUMM2=NSUMM2+1
26      AZ(I)=ATN1F(DIFY(I),-DIFX(I))
50      CONTINUE
        DO 56 I=1,50
        LJTH(I)=0
         LAZ(I)=0
        LAZDFL(I)=0
56      LTOT(I)=0
        K=0
        LINDX=0
        DO 100 J=1,NT
        IF(M(J)) 100,58,58
58      IF(XABSF(M(J))-2) 60,60,100
60      L=0
        DO 76 I=1,NT
        IF(XABSF(M(I))-XABSF(M(J))) 76,62,76
   62   IF((ABSF(AZ(J)-AZ(I)))-AZRES) 64,64,76
64      L=L+1
        NRESOL(L)=I
76      CONTINUE
72      SIDLO=SUMO
        AMB=0.
        AMBL=0.
74      IF(XABSF(M(J))-1) 75,71,75
75      RADOMA=SUML2
        GO TO 77
71      RADOMA=SUML1
77      DO 88 I=1,L
        KBAS=NRESOL(I)
        FRACT=1./RO(KBAS)**2
        FLJ=1.-ABSF((AZ(J)-AZ(KBAS))/AZRES)
        AMB=AMB+FLJ*FRACT
        IF(FRACT-RMIN2) 275,275,274
274     FRACT=RMIN2
275     AMBL=AMBL+FLJ*FRACT
        IF(J-KBAS) 88,276,88
276     TARGML=FRACT
        IF(XABSF(M(J))-1) 83,85,83
```

```
83      IF(R2(KBAS)-RMIN) 680,680,681
680     RANGMA=RMIN**2
        GO TO 682
681     RANGMA=R2(KBAS)**2
 682    CONTINUE
        DELTA=RO(J)-R2(J)
        GO TO 88
85      IF(R1(KBAS)-RMIN) 690,690,691
690     RANGMA=RMIN**2
        GO TO 692
691     RANGMA=R1(KBAS)**2
692     CONTINUE
        DELTA=RO(J)-R1(J)
88      CONTINUE
        IF(AMBL-(SUMO-AMB)*GAIN)4000,89,89
4000     KOUNT9=KOUNT9+1
        GO TO 100
89      AOSIGO=((SUMO-AMB)*GAIN+AMBL-TARGML)/TARGML
        AOSIGA=(RANGMA*RADOMA)-1.
        SIGNO=1./(2.+AOSIGO+AOSIGA+AOSIGO*AOSIGA)
        NS=SIGNO*500.
        NS=NS+1
        IF(NS-152) 8002,8002,8001
8001    NSIGNO(152)=NSIGNO(152)+1
        GO TO 8003
8002    NSIGNO(NS)=NSIGNO(NS)+1
8003     CONTINUE
        IF(SIGNO-SIG1) 99,101,101
101     KOUNT1=KOUNT1+1
        GO TO 112
99      IF(SIGNO-SIG2) 103,102,102
102     KOUNT2=KOUNT2+1
        IF(RAM2BF(0)-.6) 112,250,250
103     IF(SIGNO-SIG3) 105,104,104
104      KOUNT3=KOUNT3+1
        IF(RAM2BF(0)-.2) 112,250,250
105      KOUNT4=KOUNT4+1
250     CONTINUE
        GO TO 100
112     KOUNT5=KOUNT5+1
        IF(L-1) 113,113,114
114     KOUNT6=KOUNT6+1
        LINDX=LINDX+1
        IF(LINDX-50) 73,73,122
73      LJTH(LINDX) =J
        LJTHX(L)=LJTHX(L)+1
        LAZ(LINDX) =L
        GO TO 122
```

```
113    A2T=AZ (J)
115    ANO=(RAM2BF(O)-.5)*AZMUL
       A2T=A2T+ANO
       BNO=(RAM2BF(O)-.5)*DELMUL
       DELTA=DFLTA+ BNO
       IF(XABSF(M(J))-1) 116,116,117
116    ANGLF=A2T+CON1
       GO TO 118
117    ANGLF=A2T-CON2
118    RANGF=(2500.-DFLTA**2)/(100.*COSF(ANGLF)-2.*DELTA)
1298   CONTINUE
       K=K+1
120     XAP(K)=XO-RANGE*COSF(A2T)
121    YAP(K)=YO+RANGE*SINF(A2T)
       GO TO 100
122    NEEL=0
       DO 130 I=1,L
       KBAS=NRESOL(I)
       IF(XABSF(M(J))-1)  123,123,124
124    IF(ABSF(RO(KBAS)-R2(KBAS)-DFLTA)-DFLRES) 127,127,130
123    IF(ABSF(RO(KBAS)-R1(KBAS)-DFLTA)-DELRES) 127,127,130
127    NFFL=NFFL+1
       M(KBAS)=-M(KBAS)
       NRESOL(NEEL)=NRESOL(I)
130    CONTINUE
       LAZDEX(NEEL)=LAZDEX(NFEL)+1
       IF(NFEL-1) 517,517,132
517    KOUNT8=KOUNT8+1
       IF(LINDX-50)7000,7000,113
7000   LAZDFL(LINDX)=1
       LTOT(LINDX)=1
       GO TO 113
 132   KLOO=1
       IF(LINDX-50)133,133,134
133    LAZDFL(LINDX)=NFEL
134    IF(NRESOL(KLOO)-J) 135,150,135
135    IND=NRESOL(KLOO)
       IF(XABSF(M(J))-1) 136,136,137
136    ADELTA=RO(IND)-R1(IND)
       GO TO 140
137    ADELTA=RO(IND)-R2(IND)
140    DO 149 I=1.NT
       IF(M(I)) 149,777,777
777    IF(XABSF(M(I))-XABSF(M(J)))149,141,149
141     IF(ABSF(AZ(I)-AZ(KLOO))-AZRFS) 142,142,149
142    IF(XABSF(M(J))-1) 146,146,143
146    IF(ABSF(RO(I)-R1(I)-ADELTA)-DFLRFS) 144,144,149
144     NEEL=NFFL+1
```

```
      NRESOL(NEEL)=I
      M(I)=-M(I)
      GO TO 149
143   IF(ABSF(RO(I)-R2(I)-ADELTA)-DELRES) 144,144,149
149   CONTINUE
150   KLOO=KLOO+1
      IF(KLOO-NEEL) 134,134,152
152   LTOTX(NEEL)=LTOTX(NEEL)+1
      IF(LINDX-50)155,155,156
155   LTOT(LINDX)=NEEL
156   SUMAZ=0.
      DENOM=NEEL
      KOUNT7=KOUNT7+NEEL
      A2T=0.
      DO 160 I=1,NEEL
      KBAS=NRESOL(I)
      IF(AZ(KBAS)-A2T) 160,160,277
277   A2T=AZ(KBAS)
      IF(XABSF(M(J))-1)278,278,279
278   DELTA=RO(KBAS)-R1(KBAS)
      GO TO 160
279   DELTA=RO(KBAS)-R2(KBAS)
160   CONTINUE
      GO TO 115
100   CONTINUE
      NMS=0
      NHT=0
      NFS=0
      IF(K)570,571,570
571    DO 572 ITR=1,NT
      NMS=NMS+1
      NMST(NMS)=ITR
       NMSA(NMS)=-0
572   DISMS(NMS)=-0
      GO TO 575
570    DO 168 ITR=1,NT
      IAP=1
       NTTOAA(ITR) =1
      XTRU=X(ITR)
      YTRU=Y(ITR)
      DIFRX=ABSF(XTRU-XAP(IAP))
      DIFRY=ABSF(YTRU-YAP(IAP))
      DISSQ=DIFRY**2+DIFRX**2
      DO 166 IAP=2,K
      TDIFRX=ABSF(XTRU-XAP(IAP))
      TDIFRY=ABSF(YTRU-YAP(IAP))
       IF(TDIFRX-DIFRX) 165,164,164
```

```
164    IF(TDIFRY-DIFRY)165,166,166
165     TDISSQ=TDIFRX**2+TDIFRY**2
       IF(TDISSQ-DISSQ) 167,166,166
167    NTTOAA(ITR)=IAP
       DISSQ=TDISSQ
       DIFRX=TDIFRX
       DIFRY=TDIFRY
166    CONTINUE
168    DISTT(ITR)=SQRTF(DISSQ)
171    DO 178 IAP=1,K
       ITR=1
       NATOTT=1
       YAPP=YAP(IAP)
       XAPP=XAP(IAP)
       DIFRX=ABSF(X(ITR)-XAPP)
       DIFRY=ABSF(Y(ITR)-YAPP)
       DISSQ=DIFRX**2+DIFRY**2
172     DO 175 ITR=2,NT
       TDIFRX=ABSF(X(ITR)-XAPP)
       TDIFRY=ABSF(Y(ITR)-YAPP)
       IF(TDIFRX-DIFRX) 169,170,170
170      IF(TDIFRY-DIFRY) 169,175,175
169    TDISSQ=TDIFRX**2+TDIFRY**2
       IF(TDISSQ-DISSQ) 173,175,175
173    NATOTT=ITR
       DISSQ=TDISSQ
       DIFRX=TDIFRX
       DIFRY=TDIFRY
175     CONTINUE
         DISTA=SQRTF(DISSQ)
       IF(XABSF(NTTOAA(NATOTT))-IAP) 176,177,176
177    NHT=NHT+1
       NHTT(NHT)=NATOTT
       NHTA(NHT)=IAP
       DISHT(NHT)=DISTT(NATOTT)
       MHD=DISHT(NHT)*4.
       MHD=MHD+1
       IF(MHD-31) 1404,1405,1405
1405   DISH(31)=DISH(31)+1.
       GO TO 1406
1404   DISH(MHD)=DISH(MHD)+1.
1406   CONTINUE
       NTTOAA(NATOTT)=-NTTOAA(NATOTT)
       GO TO 178
176     NFS=NFS+1
       NFST(NFS)=NATOTT
       NFSA(NFS)=IAP
       DISFS(NFS)=SQRTF(DISSQ)
```

```
178      CONTINUE
        DO 440 ITR=1,NT
        IF(NTTOAA(ITR)) 440,440,442
442     NMS=NMS+1
        NMST(NMS)=ITR
         NMSA(NMS)=NTTOAA(ITR)
        DISMS(NMS)=DISTT(ITR)
        MDS=DISMS(NMS)/5.
        MDS=MDS+1
        IF(MDS-31) 1400,1401,1401
1401    DIST(31)=DIST(31)+1.
        GO TO 1402
1400    DIST(MDS)=DIST(MDS)+1.
1402    CONTINUE
440     CONTINUE
575     CONTINUE
        NFARAT=(1000*NFS)/K
        NMSRAT=(1000*NMS)/NT
        NDTRAT=(1000*K)/NT
        NHTRAT=(1000*NHT)/K
        KNTSUM=(10*KOUNT1+6*KOUNT2+2*KOUNT3)
        NDR=(1000*K)/(NSUMM1+NSUMM2)
        ANDR=NDR
        ANDR=ANDR/1000.
        AND2=ANDR**2
        AK1=AK1+AND2
        XX=XX+1.
        IF(XX-(51.+CLOCKS))844,843,844
843     PRINT 845
        XX=CLOCKS
        PRINT 5002
        PRINT 700,CASE,NT
845     FORMAT(1H1)
        PRINT 701
844     CONTINUE
        PRINT 702,CLOCK,K,NSUMM1,NSUMM2,NSUMM3,NMS,NHT,NFS,NFARAT,NHTRAT,
       1NMSRAT,NDTRAT,KOUNT6,KOUNT7,KOUNT8,KOUNT5,KNTSUM,KOUNT9,NDR
        KK=KK+K
        KK2=KK2+NSUMM1
        KK3=KK3+NSUMM2
        KK4=KK4+NMS
        KK5=KK5+NHT
        KK6=KK6+NFS
        KK7=KK7+KOUNT6
        KK8=KK8+KOUNT8
        AK9=AK9+ANDR
702     FORMAT(F6.0,I4,I4,3I7,2I4,I5,3I7,I6,3I7,2I8,I5)
        IF(K3) 8075,8075,8076
```

```
8076  CONTINUE
      WRITE OUTPUT TAPE 4,900,CASE,CLOCK,NT,K
900   FORMAT(F11.6,F10.0,2I5)
      DO 901 I=1,NT
901    WRITE OUTPUT TAPE 4,902,X(I),Y(I)
902   FORMAT(2F15.4)
      IF(K) 6000,6001,6000
6000  DO 903 I=1,K
903   WRITE OUTPUT TAPE 4,902,XAP(I),YAP(I)
6001  CONTINUE
8075  CONTINUE
359   IF(K6) 361,361,362
362   KEN=6
      IF(NMS) 2100,2200,2100
2100  DO 906 I=1,NMS
906    WRITE OUTPUT TAPE 3,907,KEN,CASE,CLOCK,NMST(I),NMSA(I),DISMS(I)
2200  CONTINUE
361   IF(K7) 363,363,364
364   KEN=7
      IF(NHT) 2101,2102,2101
2101  DO 908 I=1,NHT
      IS=NHTA(I)
      ID=NHTT(I)
908   WRITE OUTPUT TAPE 3,907,KEN,CASE,CLOCK,NHTT(I),NHTA(I),DISHT(I),
     1X(ID),Y(ID),XAP(IS),YAP(IS)
2102  CONTINUE
363    IF(K8) 365,365,366
366   KEN=8
      IF(NFS) 2103,2104,2103
2103  DO 909 I=1,NFS
909   WRITE OUTPUT TAPE 3,907,KEN,CASE,CLOCK,NFST(I),NFSA(I),DISFS(I)
365    CONTINUE
2104  CONTINUE
        CLOCK=CLOCK+1.
      IF(CLOCK-CLOCKL) 999,999,301
999   DO 998 I=1,NT
      Y(I)=Y(I)+DELY(I)
998   X(I)=X(I)+DELX(I)
      GO TO 7
301   KEN=0
5555  FORMAT(4H TOTI6,I5,I6,I13,2I5,I31,I14,F28.3)
      PRINT 5555,KK,KK2,KK3,KK4,KK5,KK6,KK7,KK8,AK9
      PRINT 6500,AK1
6500  FORMAT(F120.6)
5557   FORMAT(7H  TOTALI14,I9.I15)
      PRINT 845
      PRINT 1666
      PRINT 700,CASE,NT
      PRINT 5002
1666  FORMAT(56H                 HITS                               MISSES
     1)
      PRINT 1667
1667  FORMAT(70H      LOWER   UPPER   NUMBER   STD FREQ      LOWER UPPER   NUM
     1BER  STD FREQ   )
1408  FORMAT(37H       HITS                         MISSES   )
1409  FORMAT(46H LOWER   UPPER NUMBER        LOWER   UPPER NUMBER   )
      XLOW=0.
      HIGH=5.
      XLO=0.
      HIG=.25
      DO 1668 I=1,31
      SUX=SUX+DIST(I)
1668  SUM=SUM+DISH(I)
      SUX=1000./SUX
      SUM=1000./SUM
      DO 1411 I=1,31
      LXX=DISH(I)*SUM+.5
      LYY=DIST(I)*SUX+.5
      PRINT 1410,XLO,HIG,DISH(I),LXX,XLOW,HIGH,DIST(I),LYY
      FREQ=(HIG-XLO)/2.+XLO
      FRED=(HIGH-XLOW)/2.+XLOW
      FREQ2=FREQ2+FREQ**2*DISH(I)
      FRED2=FRED2+FRED**2*DIST(I)
      FRE1=FRE1+FREQ*DISH(I)
      FRE2=FRE2+FRED*DIST(I)
      DXH=DXH+DISH(I)
      DXM=DXM+DIST(I)
      XLOW=HIGH
      HIGH=HIGH+5.
      XLO=HIG
1411  HIG=HIG+.25
1410  FORMAT(F10.2,F7.2,F8.0,I10,F10.0,F7.0,F8.0,I10)
      SIGMAH=SQRTF(FREQ2/DXH-(FRE1/DXH)**2)
      SIGMAM=SQRTF(FRED2/DXM-(FRE2/DXM)**2)
      BARH=FRE1/DXH
      BARM=FRE2/DXM
      PRINT 1669,SIGMAH,SIGMAM,BARH,BARM
1669  FORMAT(13H     SIGMA HITF8.3,11H SIGMA MISSF8.3,9H MEAN HITF9.3,10H
     1 MEAN MISSF9.3)
      IF(KO) 369,369,370
370   HIGH=.002
      PRINT 5000
 5000 FORMAT (1H1)
      PRINT 5002
      PRINT 700,CASE,NT
```

```
       PRINT 450
450    FORMAT(48H          FREQUENCY DISTRIBUTION SIGNAL TO NOISE  )
       PRINT 451
451    FORMAT(42H      LIMITS                            LIMITS  )
       PRINT 452
452    FORMAT(86H LOWER    UPPER    NUMBER      LOWER    UPPER    NUMBER
      1      LOWER    UPPER    NUMBER  )
       XLOW=.0
       XLOWR=.102
       XLO=.204
       XHIG=.206
        HIGHR=.104
       DO 453 I=1,51
       PRINT 454,XLOW,HIGH,NSIGNO(I),XLOWR,HIGHR,NSIGNO(I+51),XLO,XHIG,
      1NSIGNO(I+101)
454    FORMAT(F6.3,F9.3,I8,F13.3,F9.3,I8,F13.3,F9.3,I8)
       XLO=XHIG
        XHIG=XHIG+.002
888    FORMAT(F6.1,F9.3,I8,F13.3,F9.3,I8)
       XLOW=HIGH
        HIGH=HIGH+.002
       XLOWR=HIGHR
453    HIGHR=HIGHR+.002
369    CONTINUE
   465 FORMAT(17H DURING THIS RAIDI4,53H AZIMUTH UNRESOLVE SECTORS WERE F
      XOUND WHICH CONTAINEDI5,8H TARGETS)
       IF(K1) 460,460,461
461    PRINT 5000
       PRINT 700,CASE,NT
       PRINT 472
       LL1=0
       LL2=0
       LL3=0
        DO 464 I=2,50
       LL1=LL1+LJTHX(I)
       LL2=LL2+LAZDEX(I)
5556   LL3=LL3+LTOTX(I)
464    PRINT 462,I,LJTHX(I),LAZDEX(I),LTOTX(I),I
       PRINT 5557,LL1,LL2,LL3
472    FORMAT(57H  NO TARGETS   AZ UNR   AZ+DEL  AZ+DEL+OTHERS  NO TARGET
      1S )
462    FORMAT(I12,2I9,I15,I9)
460    CONTINUE
       PAUSE 1
       GO TO 1500
907    FORMAT(I5,F10.5,F5.0,2I8,5F8.2)
 904   FORMAT(I5,F10.5,F5.0,5I8)
       END(0,1,0,0,1)
```

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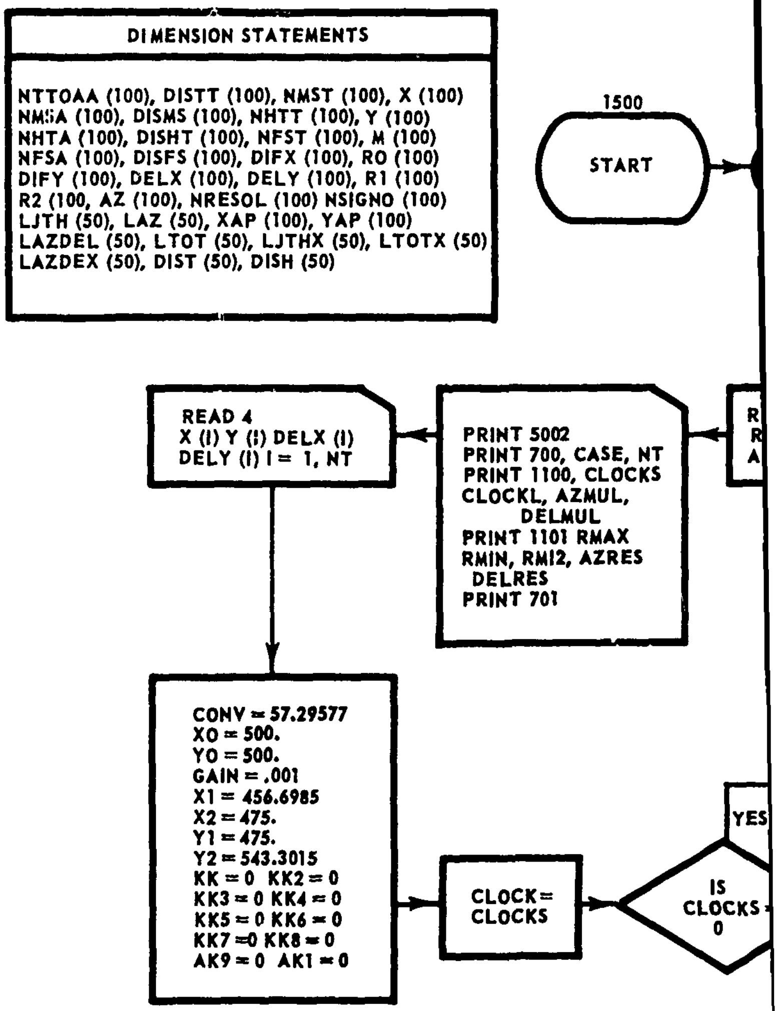

DIMENSION STATEMENTS
NTTOAA (100), DISTT (100), NMST (100), X (100)
NMSA (100), DISMS (100), NHTT (100), Y (100)
NHTA (100), DISHT (100), NFST (100), M (100)
NFSA (100), DISFS (100), DIFX (100), RO (100)
DIFY (100), DELX (100), DELY (100), R1 (100)
R2 (100, AZ (100), NRESOL (100) NSIGNO (100)
LJTH (50), LAZ (50), XAP (100), YAP (100)
LAZDEL (50), LTOT (50), LJTHX (50), LTOTX (50)
LAZDEX (50), DIST (50), DISH (50)
1500
START
R
R
A
PRINT 5002
PRINT 700, CASE, NT
PRINT 1100, CLOCKS
CLOCKL, AZMUL,
DELMUL
PRINT 1101 RMAX
RMIN, RMI2, AZRES
DELRES
PRINT 701
READ 4
X (I) Y (I) DELX (I)
DELY (I) I = 1, NT
CONV = 57.29577
XO = 500.
YO = 500.
GAIN = .001
X1 = 456.6985
X2 = 475.
Y1 = 475.
Y2 = 543.3015
KK = 0 KK2 = 0
KK3 = 0 KK4 = 0
KK5 = 0 KK6 = 0
KK7 = 0 KK8 = 0
AK9 = 0 AK1 = 0
CLOCK= CLOCKS
YES
IS CLOCKS = 0

A.

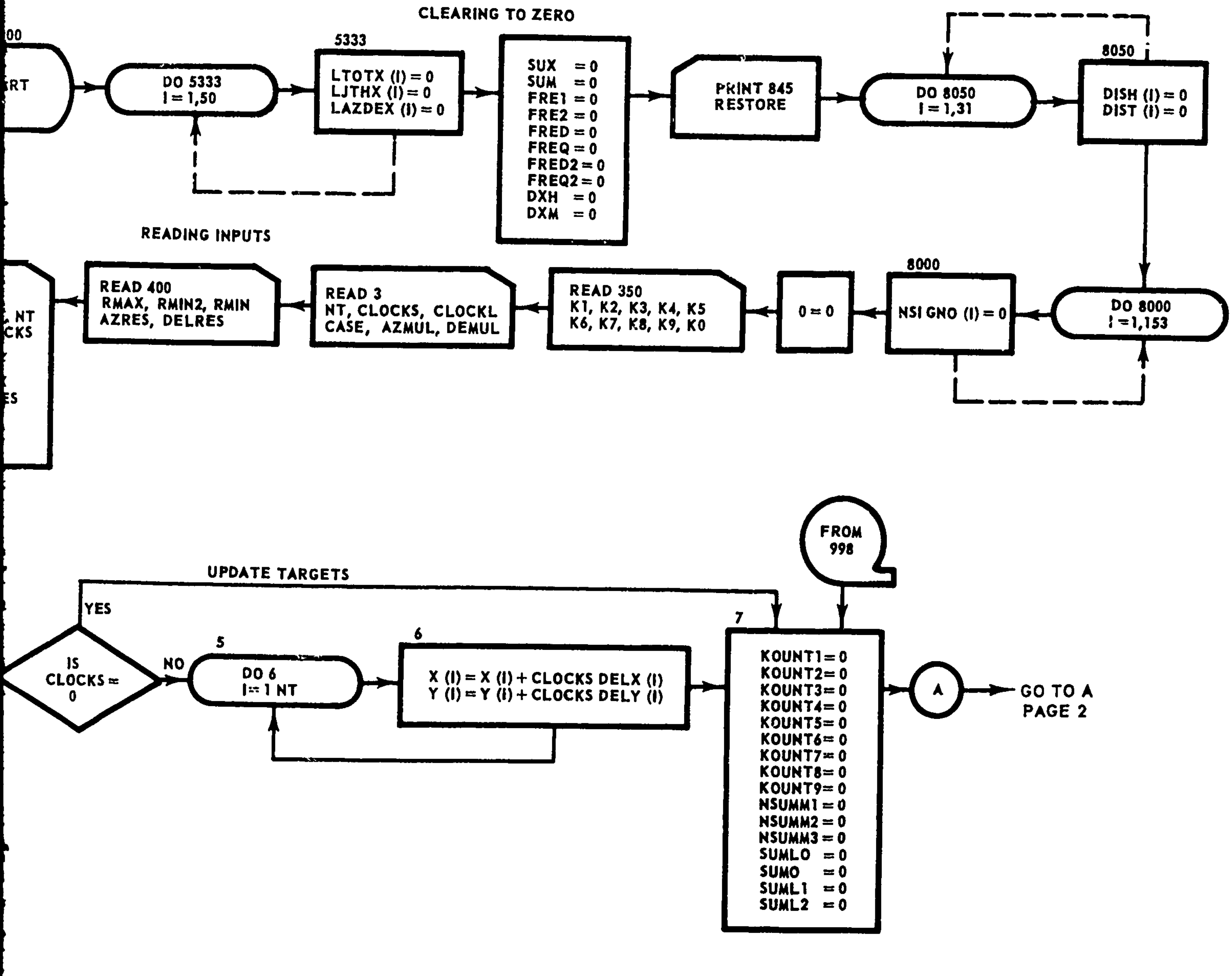
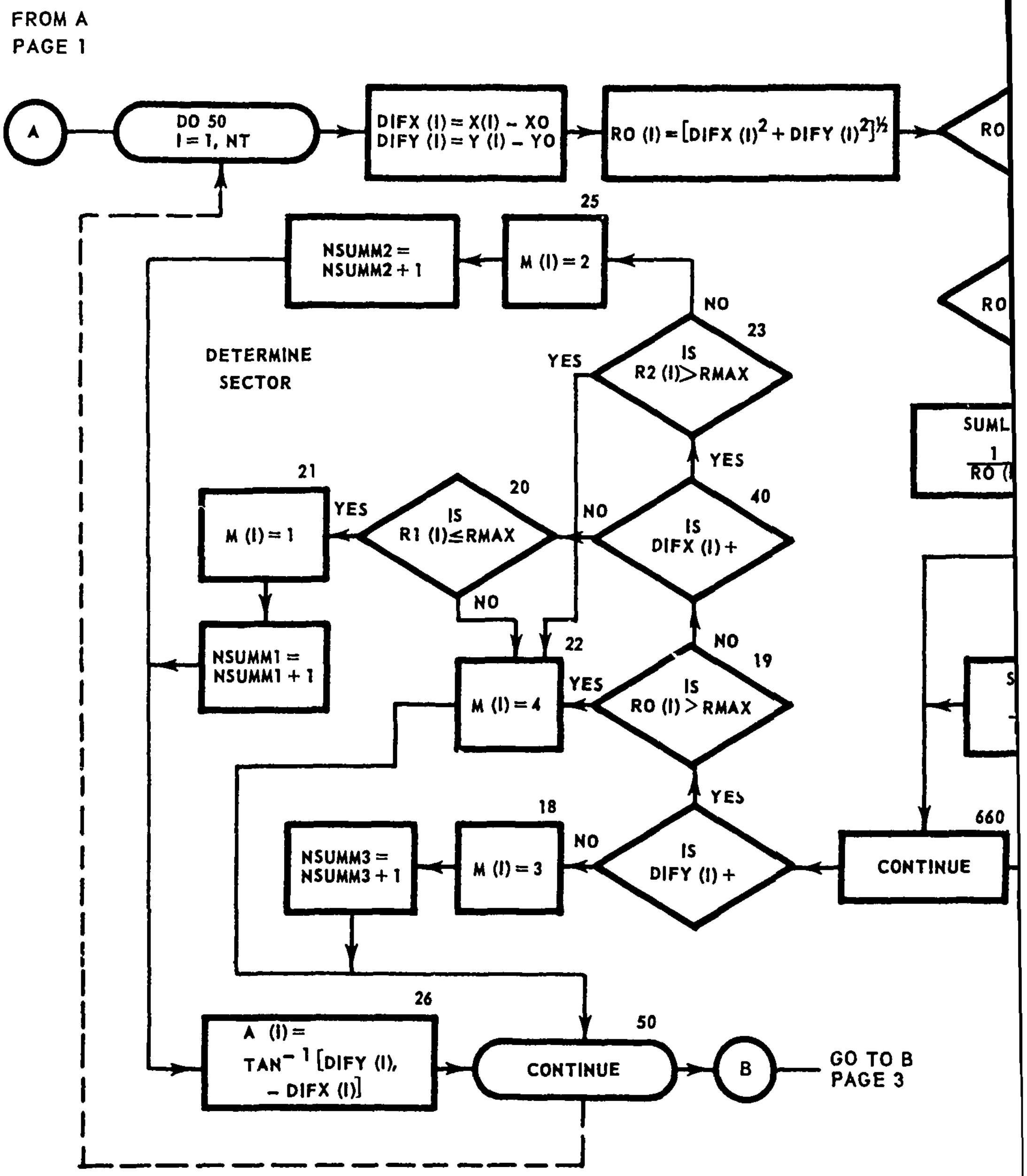


Figure 2-1 Original Program Flow Diagram

B,


FROM A
PAGE 1
A
DO 50
I = 1, NT
DIFX (I) = X(I) – XO
DIFY (I) = Y (I) – YO
RO (I) = [DIFX (I)^2 + DIFY (I)^2]$^{1/2}$
RO
25
NSUMM2 =
NSUMM2 + 1
M (I) = 2
NO
RO
23
DETERMINE
SECTOR
YES
IS
R2 (I) > RMAX
SUML
1
RO (I
YES
21
20
40
YES
IS
R1 (I) ≤ RMAX
NO
IS
DIFX (I) +
M (I) = 1
NO
NO
22
19
NSUMM1 =
NSUMM1 + 1
M (I) = 4
YES
IS
RO (I) > RMAX
S
YES
18
660
NSUMM3 =
NSUMM3 + 1
M (I) = 3
NO
IS
DIFY (I) +
CONTINUE
26
50
A (I) =
TAN^{-1} [DIFY (I),
– DIFX (I)]
CONTINUE
B
GO TO B
PAGE 3

A.

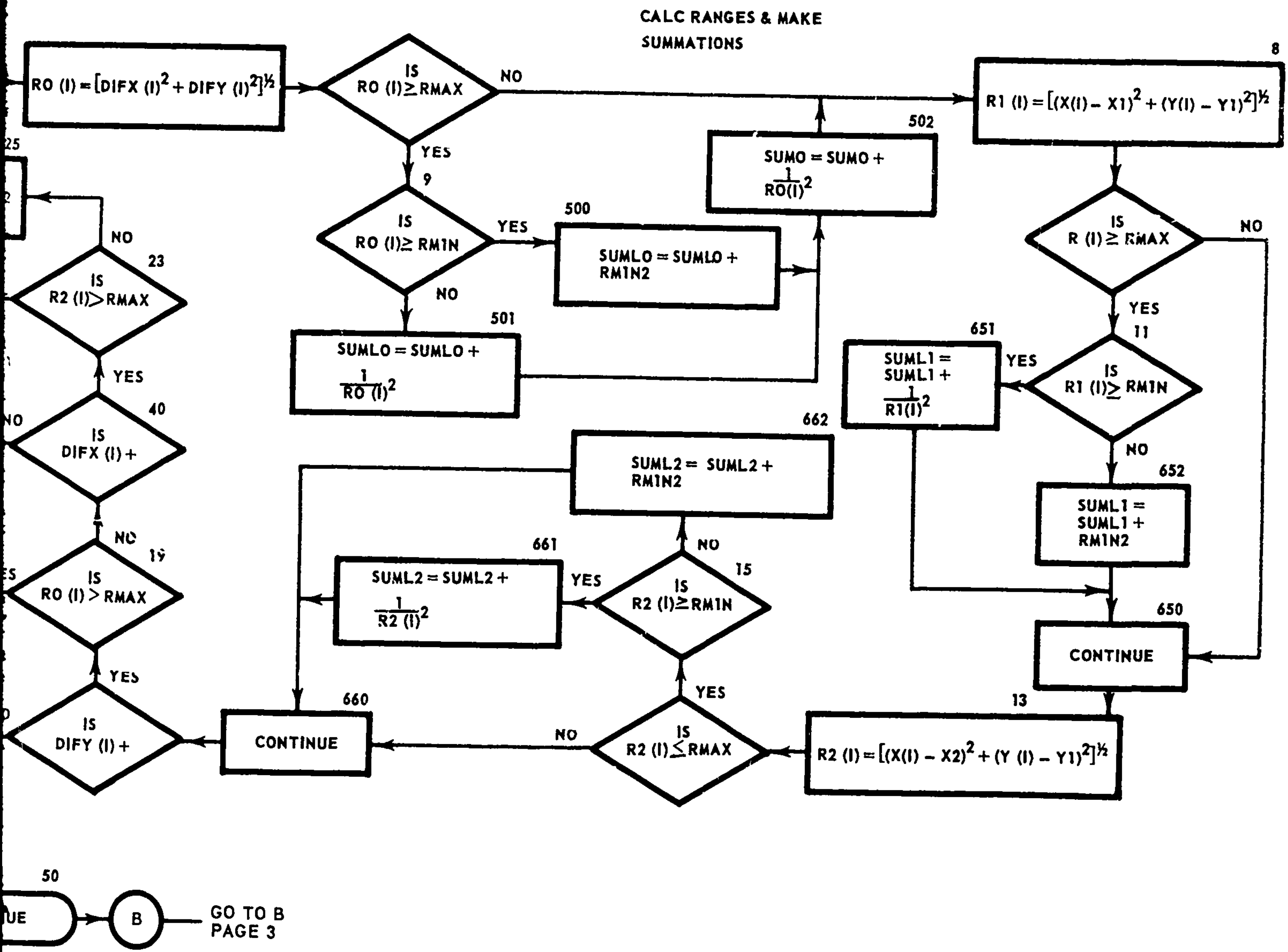
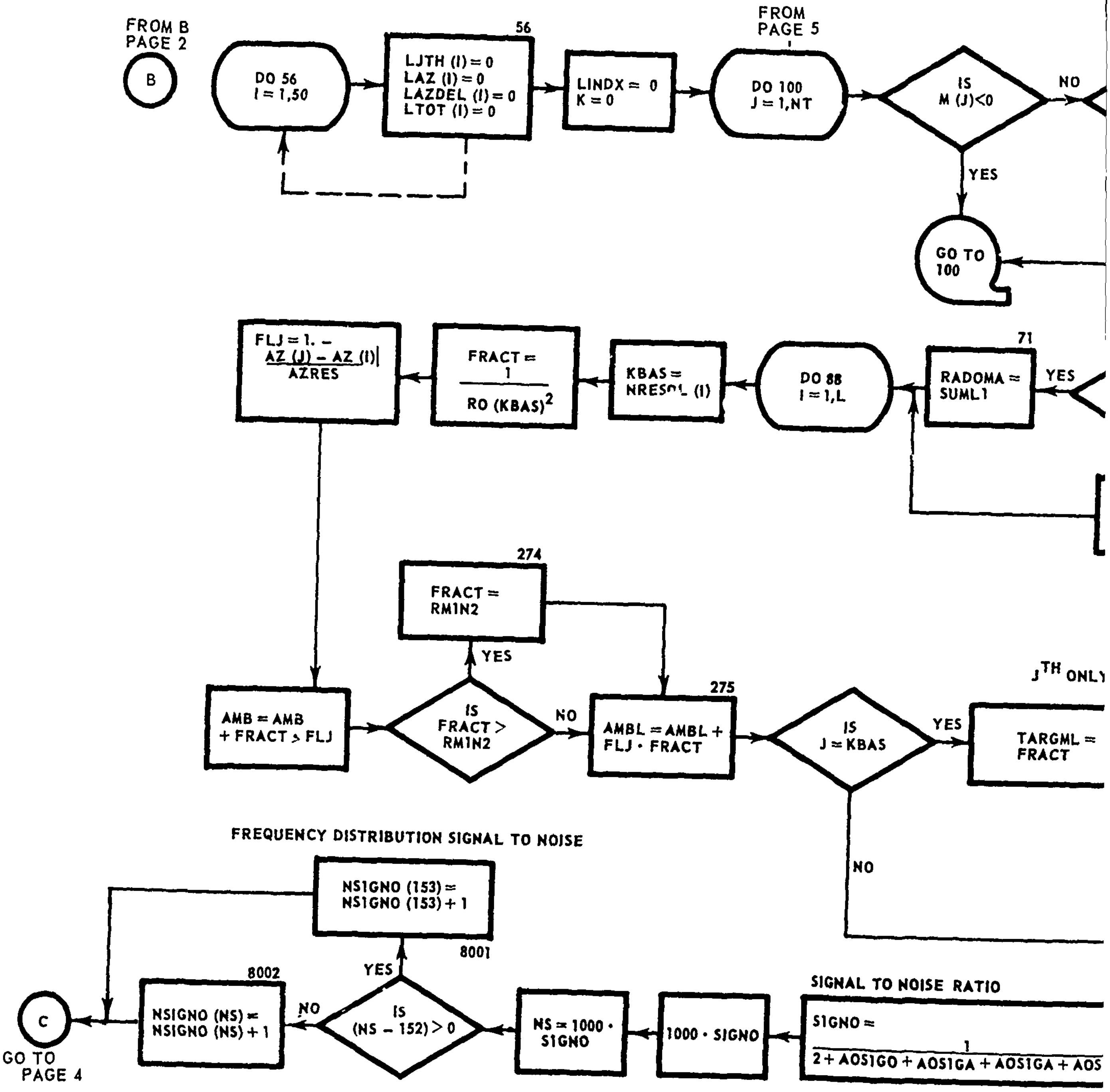


Figure 2-1 (Cont.)

B,


FROM B
PAGE 2
B
DO 56
I = 1,50
56
LJTH (I) = 0
LAZ (I) = 0
LAZDEL (I) = 0
LTOT (I) = 0
LINDX = 0
K = 0
FROM
PAGE 5
DO 100
J = 1,NT
IS
M (J)<0
NO
YES
GO TO
100
FLJ = 1. − |AZ (J) − AZ (I)| / AZRES
FRACT = 1 / RO (KBAS)²
KBAS =
NRESOL (I)
DO 88
I = 1,L
71
RADOMA =
SUML1
YES
274
FRACT =
RMIN2
YES
Jth ONLY
275
AMB = AMB
+ FRACT × FLJ
IS
FRACT >
RMIN2
NO
AMBL = AMBL +
FLJ · FRACT
IS
J = KBAS
YES
TARGML =
FRACT
NO
FREQUENCY DISTRIBUTION SIGNAL TO NOISE
NSIGNO (153) =
NSIGNO (153) + 1
8001
YES
8002
SIGNAL TO NOISE RATIO
C
GO TO
PAGE 4
NSIGNO (NS) =
NSIGNO (NS) + 1
NO
IS
(NS − 152) > 0
NS = 1000 ·
SIGNO
1000 · SIGNO
SIGNO = 1 / 2 + AOSIGO + AOSIGA + AOSIGA + AOS

A1

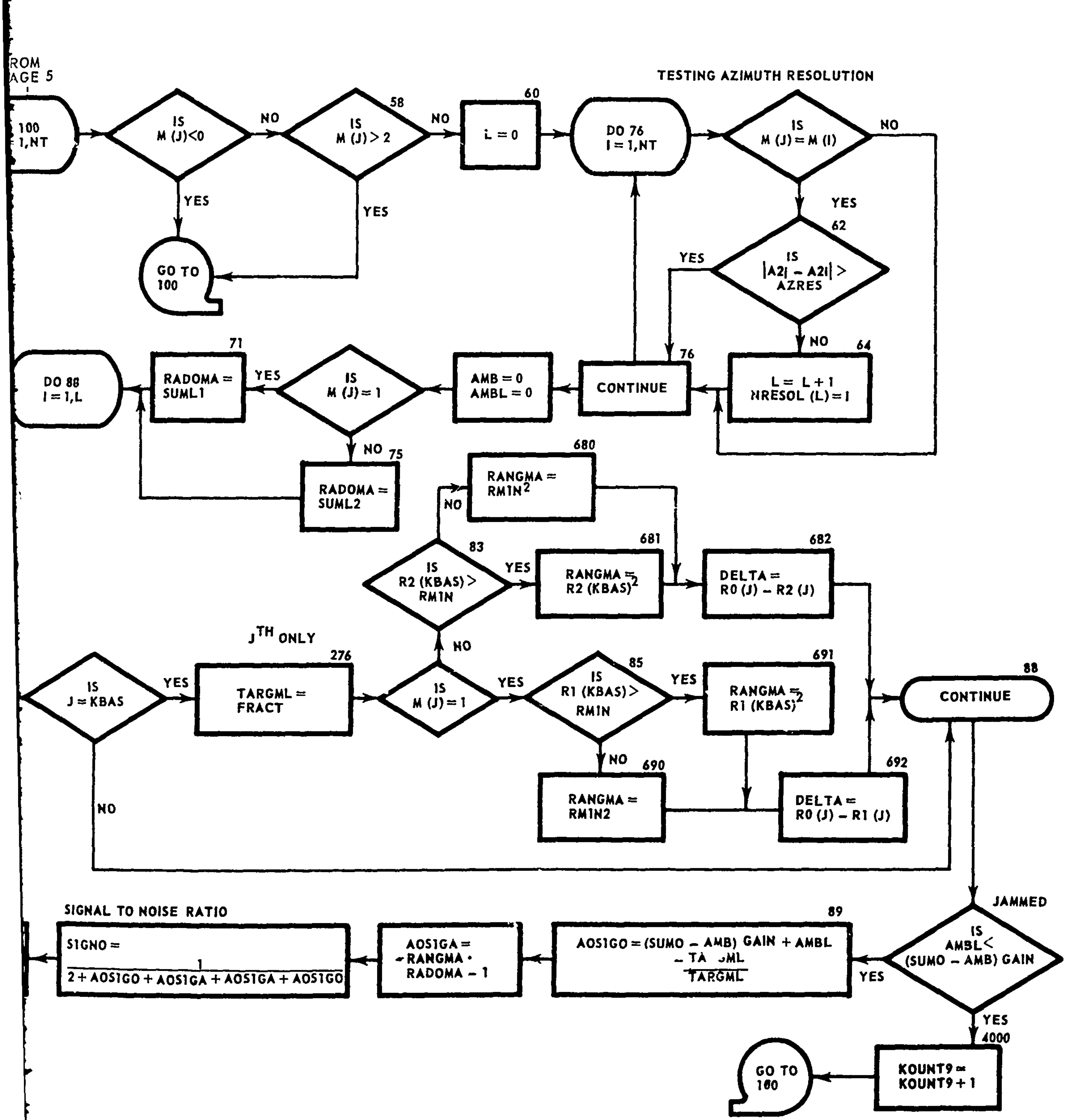
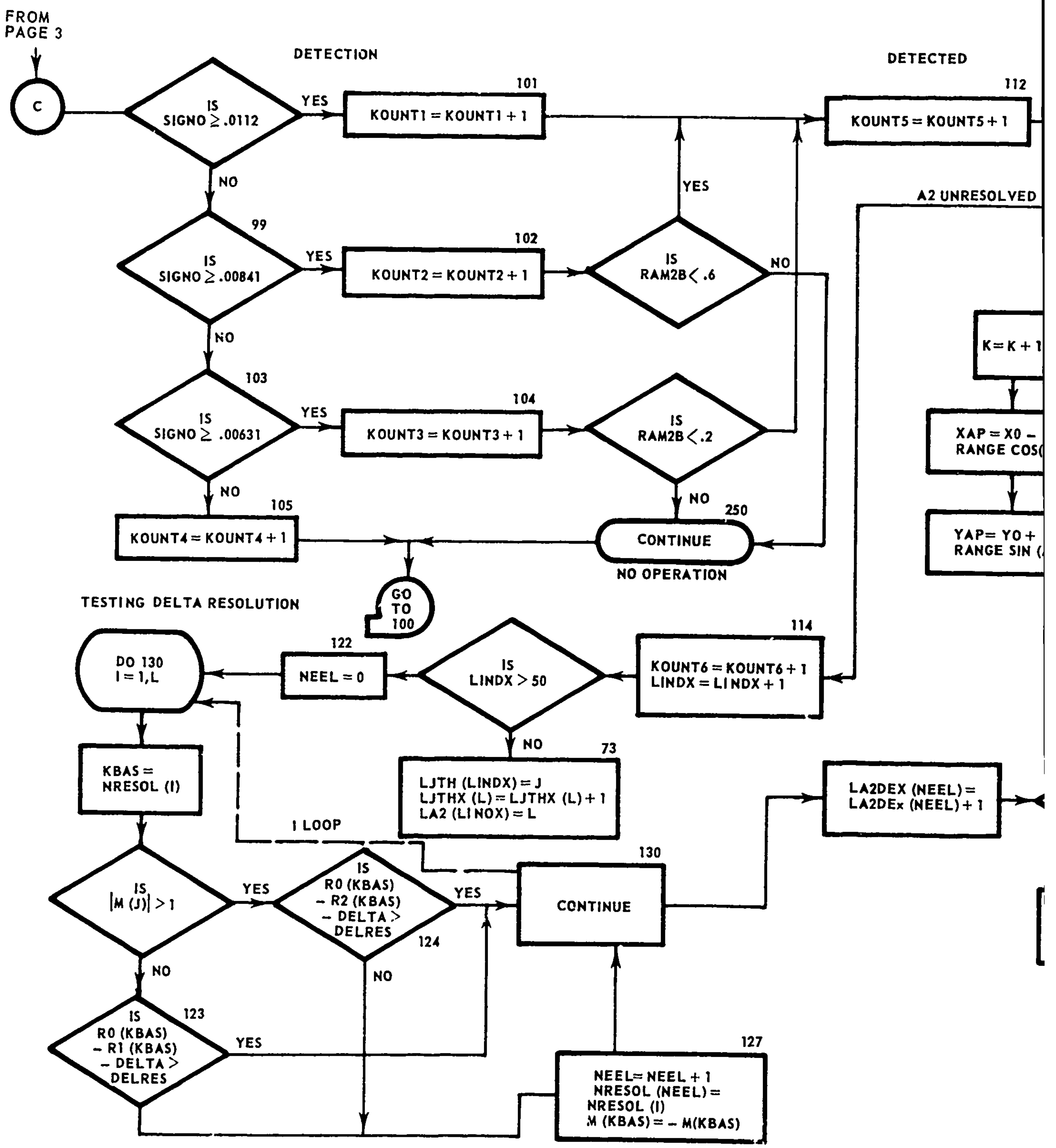


Figure 2-1 (Cont.)

B.


FROM PAGE 3
C
DETECTION
IS SIGNO ≥ .0112
YES
NO
101
KOUNT1 = KOUNT1 + 1
DETECTED
112
KOUNT5 = KOUNT5 + 1
YES
A2 UNRESOLVED
99
IS SIGNO ≥ .00841
YES
102
KOUNT2 = KOUNT2 + 1
IS RAM2B < .6
NO
NO
K = K + 1
103
IS SIGNO ≥ .00631
YES
104
KOUNT3 = KOUNT3 + 1
IS RAM2B < .2
XAP = X0 – RANGE COS(
NO
NO
105
KOUNT4 = KOUNT4 + 1
250
CONTINUE
NO OPERATION
YAP = Y0 + RANGE SIN (
GO TO 100
TESTING DELTA RESOLUTION
114
122
DO 130 I = 1,L
NEEL = 0
IS LINDX > 50
KOUNT6 = KOUNT6 + 1
LINDX = LINDX + 1
NO
73
KBAS = NRESOL (I)
LJTH (LINDX) = J
LJTHX (L) = LJTHX (L) + 1
LA2 (LINOX) = L
LA2DEX (NEEL) = LA2DEx (NEEL) + 1
I LOOP
130
IS |M (J)| > 1
YES
IS R0 (KBAS) – R2 (KBAS) – DELTA > DELRES
YES
CONTINUE
124
NO
NO
123
IS R0 (KBAS) – R1 (KBAS) – DELTA > DELRES
YES
127
NEEL = NEEL + 1
NRESOL (NEEL) = NRESOL (I)
M (KBAS) = – M(KBAS)

A.

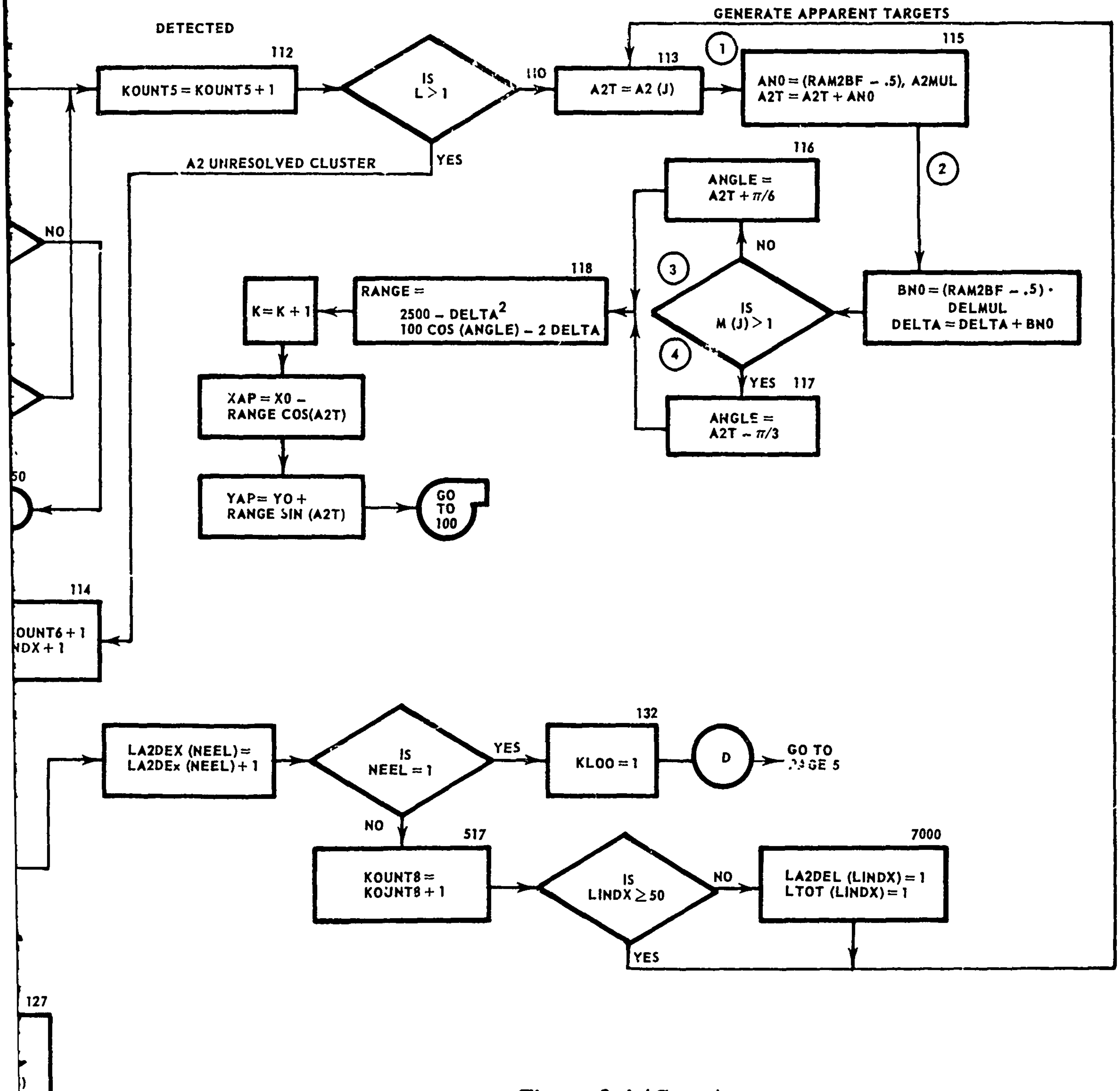
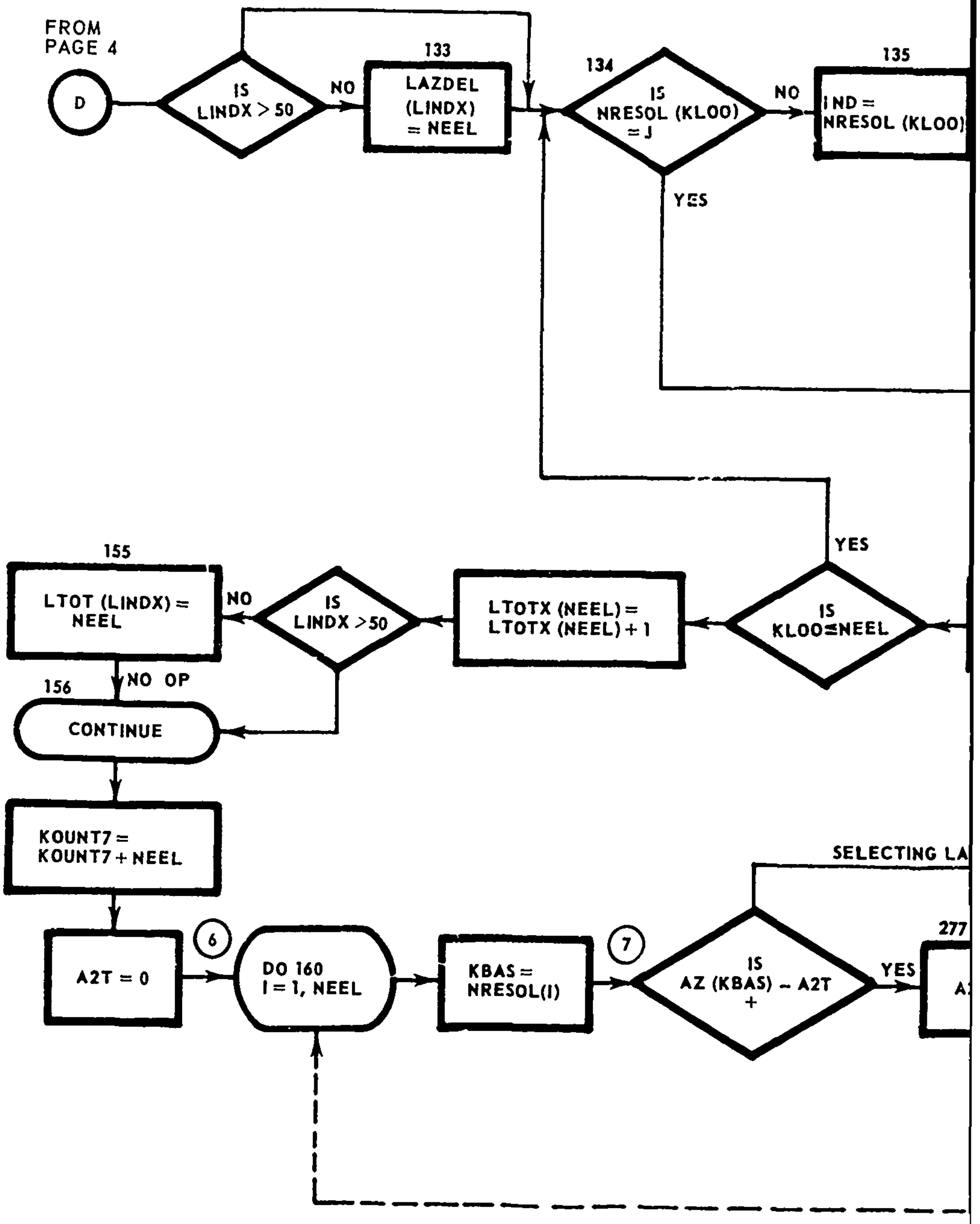


Figure 2-1 (Cont.)

B.


FROM PAGE 4
D
IS LINDX > 50
NO
133
LAZDEL (LINDX) = NEEL
134
IS NRESOL (KLOO) = J
NO
YES
135
IND = NRESOL (KLOO)
YES
155
LTOT (LINDX) = NEEL
NO
IS LINDX >50
LTOTX (NEEL) = LTOTX (NEEL) + 1
IS KLOO≤NEEL
NO OP
156
CONTINUE
KOUNT7 = KOUNT7 + NEEL
SELECTING LA
277
A2T = 0
6
DO 160 I = 1, NEEL
KBAS = NRESOL(I)
7
IS AZ (KBAS) – A2T +
YES
A

A,

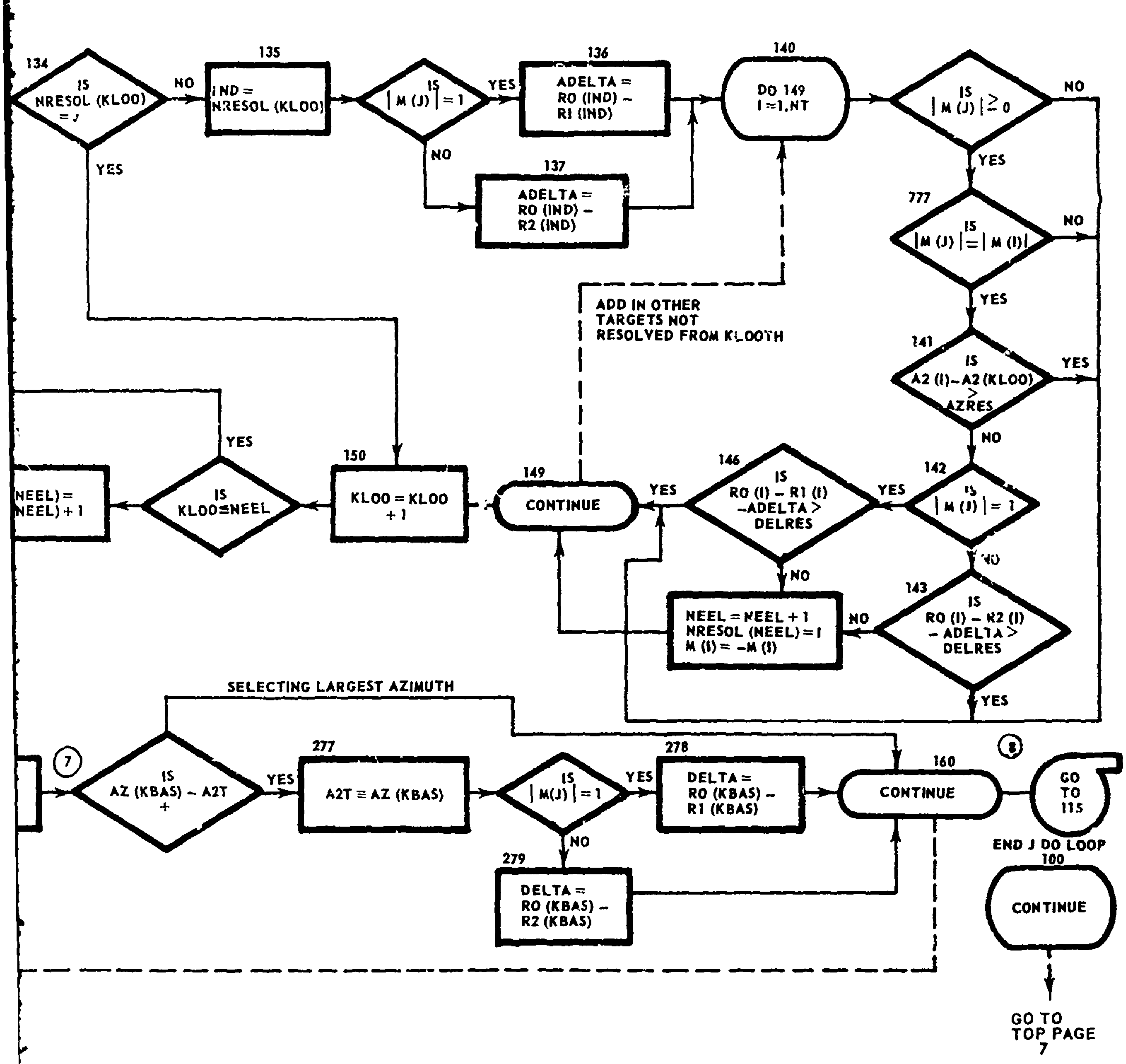
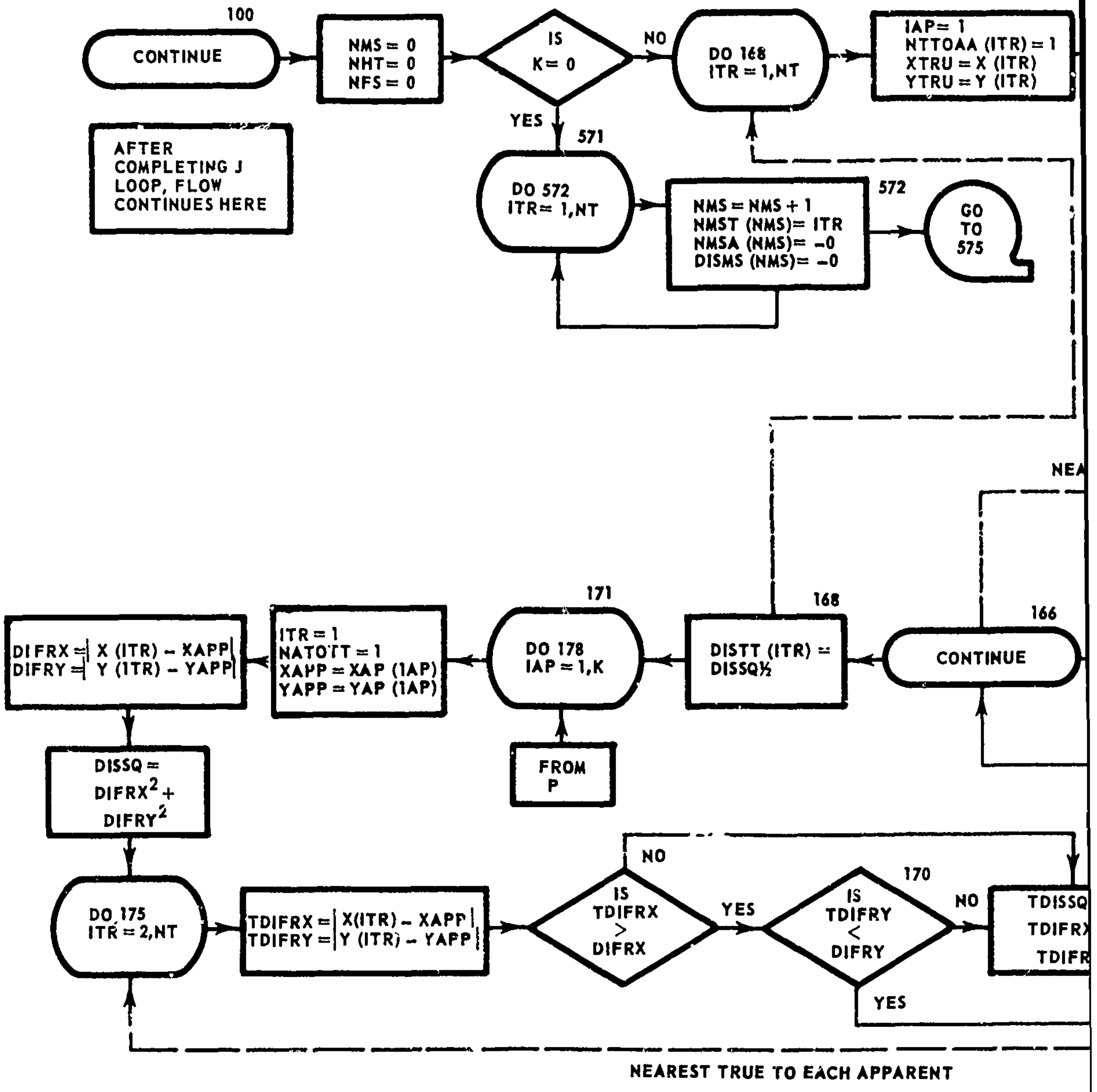


Figure 2-1 (Cont.)

B.


100
CONTINUE
NMS = 0
NHT = 0
NFS = 0
IS
K = 0
NO
YES
DO 168
ITR = 1,NT
IAP = 1
NTTOAA (ITR) = 1
XTRU = X (ITR)
YTRU = Y (ITR)
AFTER COMPLETING J LOOP, FLOW CONTINUES HERE
571
DO 572
ITR = 1,NT
572
NMS = NMS + 1
NMST (NMS) = ITR
NMSA (NMS) = -0
DISMS (NMS) = -0
GO TO 575
NEA
171
168
166
DIFRX = | X (ITR) - XAPP|
DIFRY = | Y (ITR) - YAPP|
ITR = 1
NATOTT = 1
XAPP = XAP (IAP)
YAPP = YAP (IAP)
DO 178
IAP = 1,K
DISTT (ITR) = DISSQ½
CONTINUE
FROM P
DISSQ = DIFRX^2 + DIFRY^2
NO
170
DO 175
ITR = 2,NT
TDIFRX = | X(ITR) - XAPP|
TDIFRY = | Y (ITR) - YAPP|
IS TDIFRX > DIFRX
YES
IS TDIFRY < DIFRY
NO
YES
TDISSQ
TDIFRX
TDIFR
NEAREST TRUE TO EACH APPARENT

A,

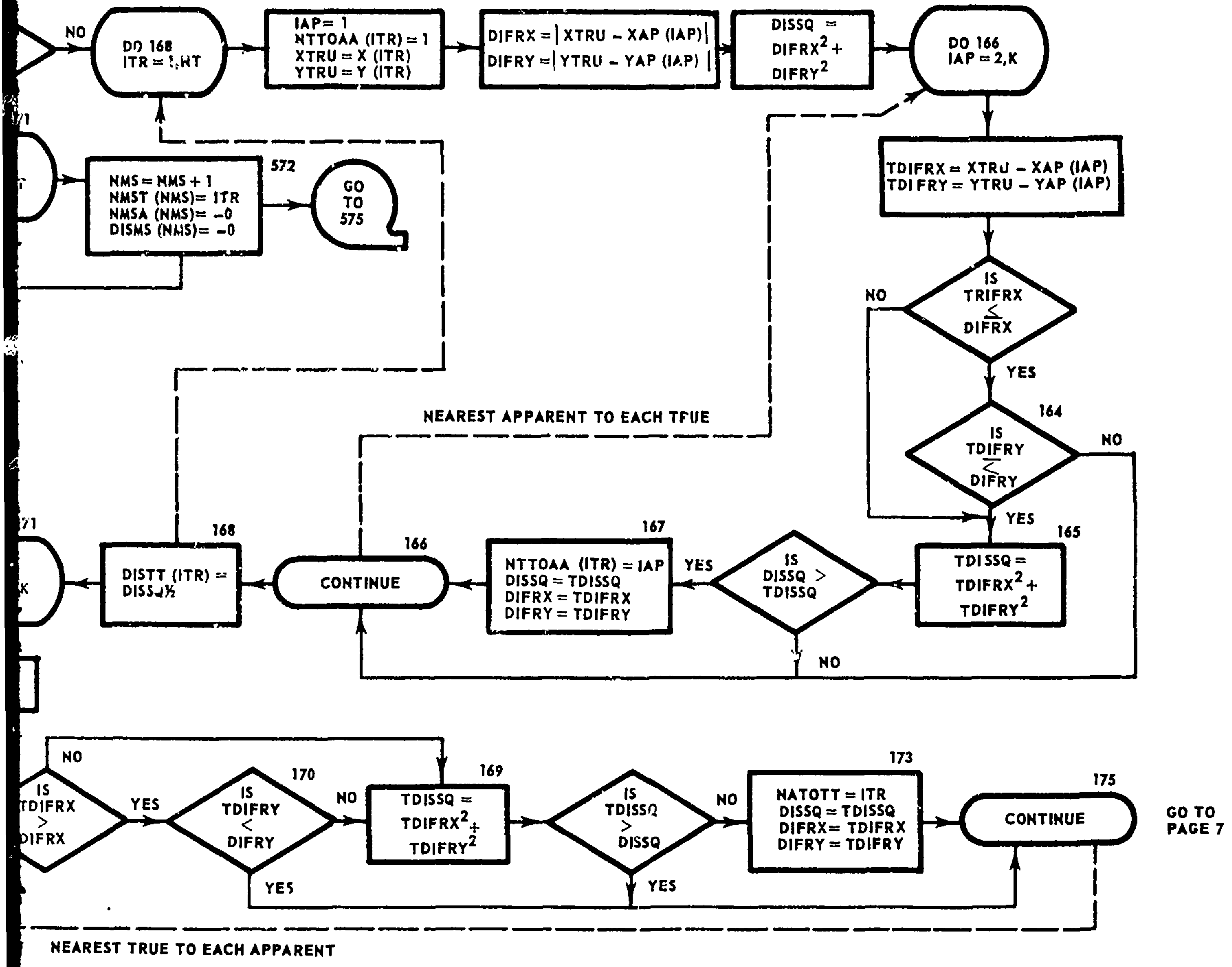
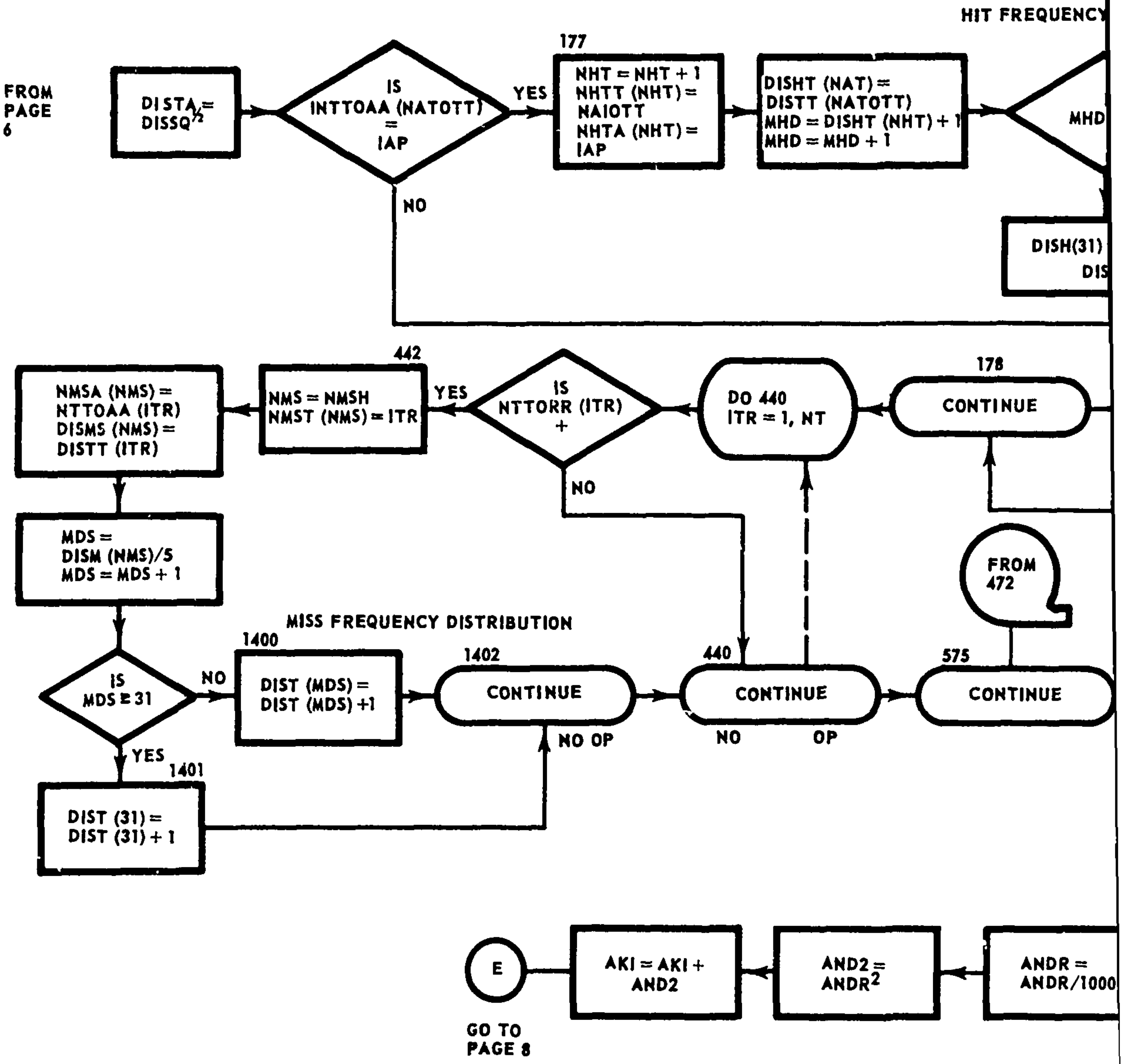


Figure 2-1 (Cont.)

B.


HIT FREQUENCY
FROM PAGE 6
DISTA = DISSQ½
IS INTTOAA (NATOTT) = IAP
YES
NO
177
NHT = NHT + 1
NHTT (NHT) = NAIOTT
NHTA (NHT) = IAP
DISHT (NAT) = DISTT (NATOTT)
MHD = DISHT (NHT) + 1
MHD = MHD + 1
MHD
DISH(31)
DIS
442
NMSA (NMS) = NTTOAA (ITR)
DISMS (NMS) = DISTT (ITR)
NMS = NMSH
NMST (NMS) = ITR
YES
IS NTTORR (ITR) +
NO
DO 440
ITR = 1, NT
178
CONTINUE
MDS = DISM (NMS)/5
MDS = MDS + 1
FROM 472
MISS FREQUENCY DISTRIBUTION
1400
1402
440
575
IS MDS ≥ 31
NO
DIST (MDS) = DIST (MDS) +1
CONTINUE
CONTINUE
CONTINUE
NO OP
NO OP
YES
1401
DIST (31) = DIST (31) + 1
E
GO TO PAGE 8
AKI = AKI + AND2
AND2 = ANDR^2
ANDR = ANDR/1000

A.

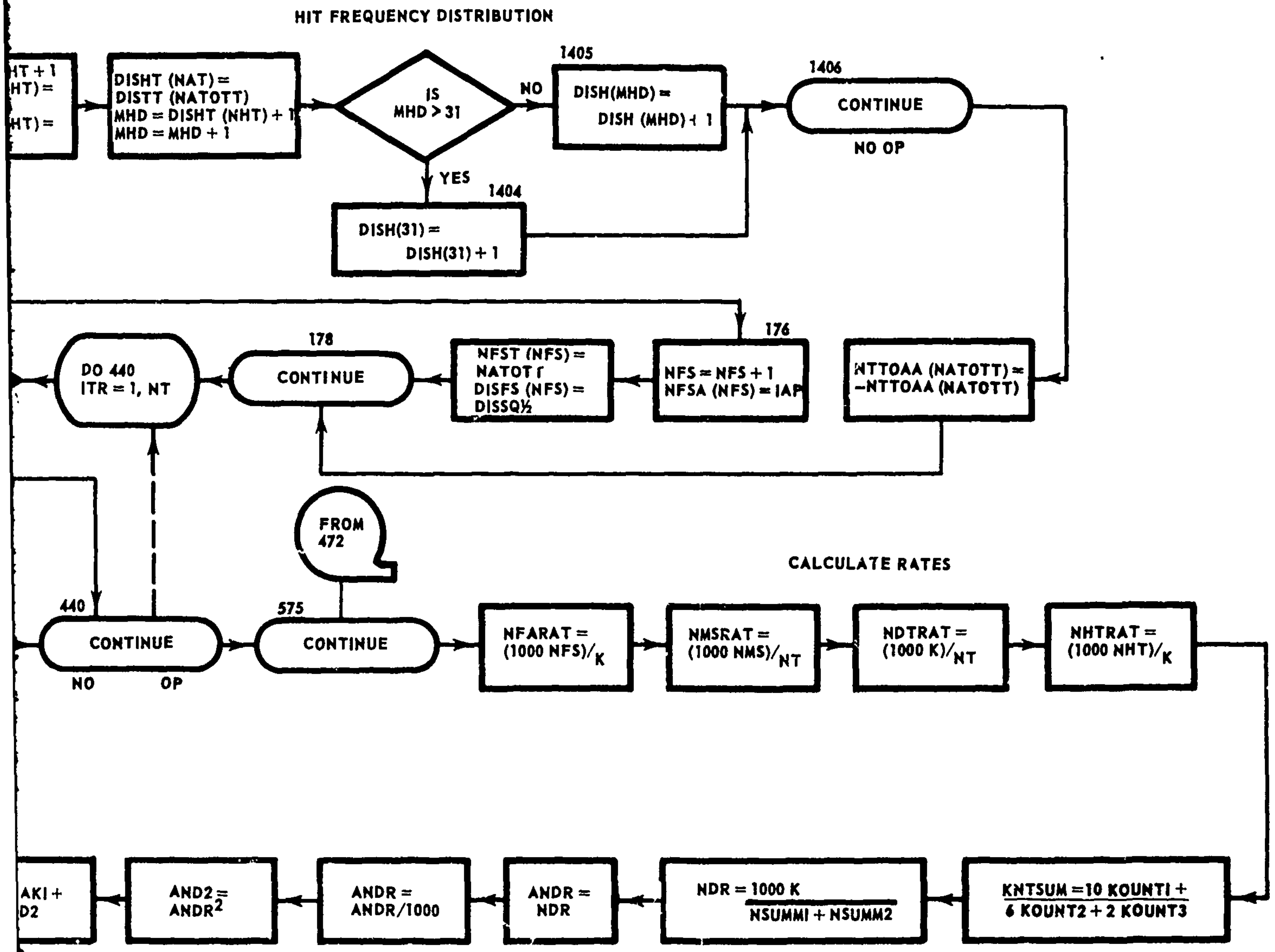
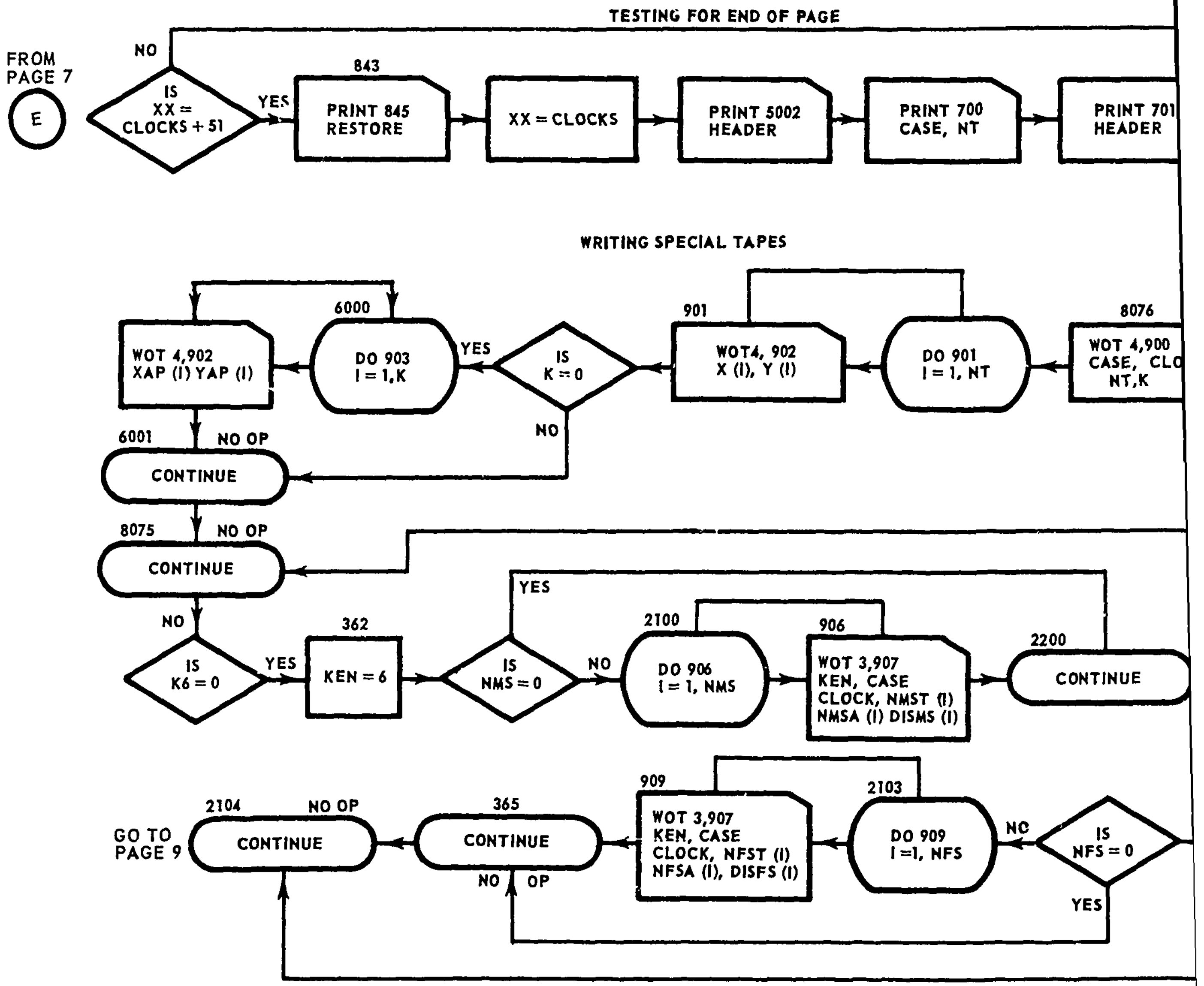


Figure 2-1 (Cont.)

B.


TESTING FOR END OF PAGE
FROM PAGE 7
E
NO
IS XX = CLOCKS + 51
YES
843
PRINT 845 RESTORE
XX = CLOCKS
PRINT 5002 HEADER
PRINT 700 CASE, NT
PRINT 701 HEADER
WRITING SPECIAL TAPES
6000
WOT 4,902 XAP (I) YAP (I)
DO 903 I = 1,K
YES
IS K = 0
NO
901
WOT4, 902 X (I), Y (I)
DO 901 I = 1, NT
8076
WOT 4,900 CASE, CLO NT,K
6001
NO OP
CONTINUE
8075
NO OP
CONTINUE
NO
IS K6 = 0
YES
362
KEN = 6
YES
IS NMS = 0
NO
2100
DO 906 I = 1, NMS
906
WOT 3,907 KEN, CASE CLOCK, NMST (I) NMSA (I) DISMS (I)
2200
CONTINUE
909
WOT 3,907 KEN, CASE CLOCK, NFST (I) NFSA (I), DISFS (I)
2103
DO 909 I =1, NFS
NO
IS NFS = 0
YES
365
CONTINUE
NO OP
2104
NO OP
CONTINUE
GO TO PAGE 9

A1

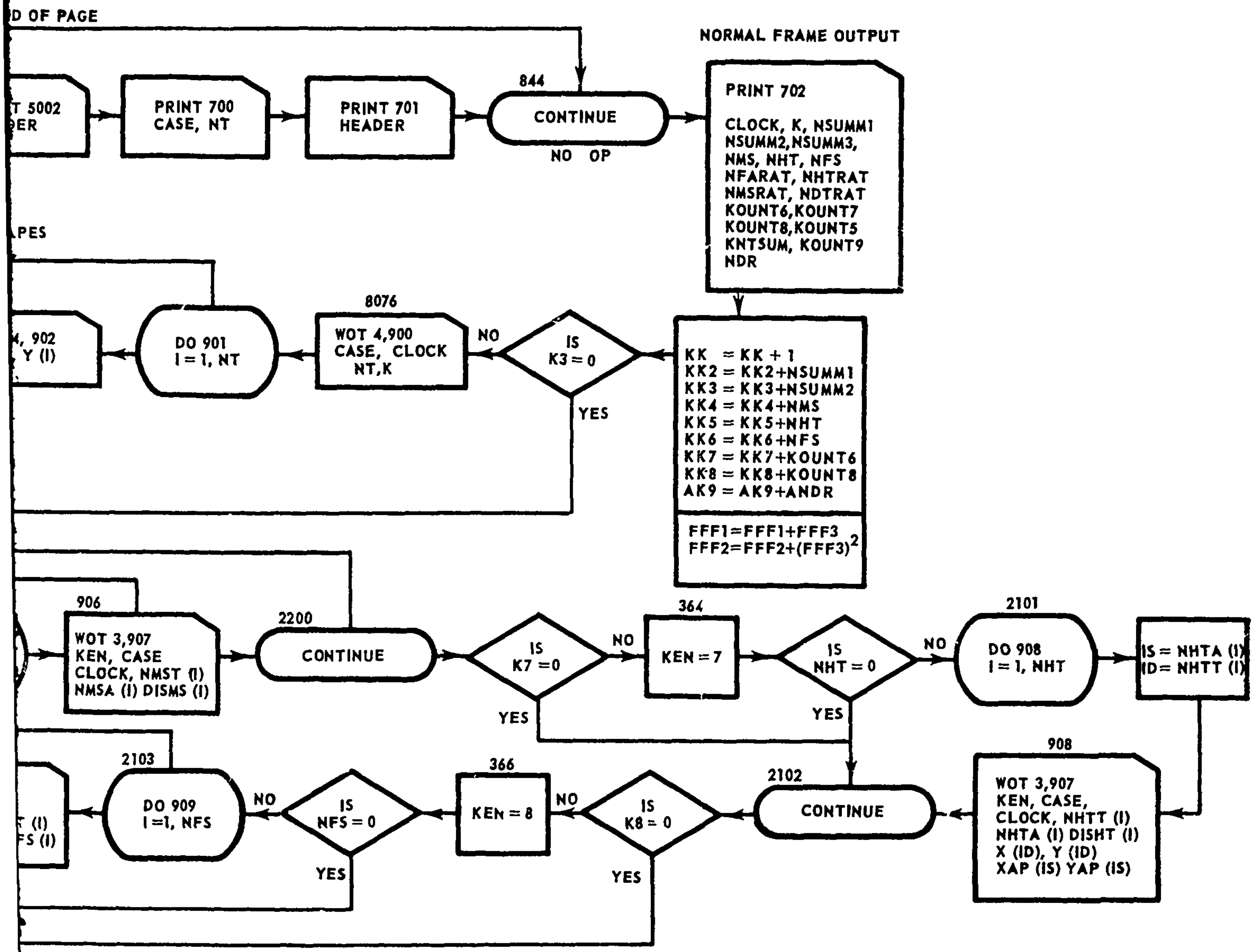
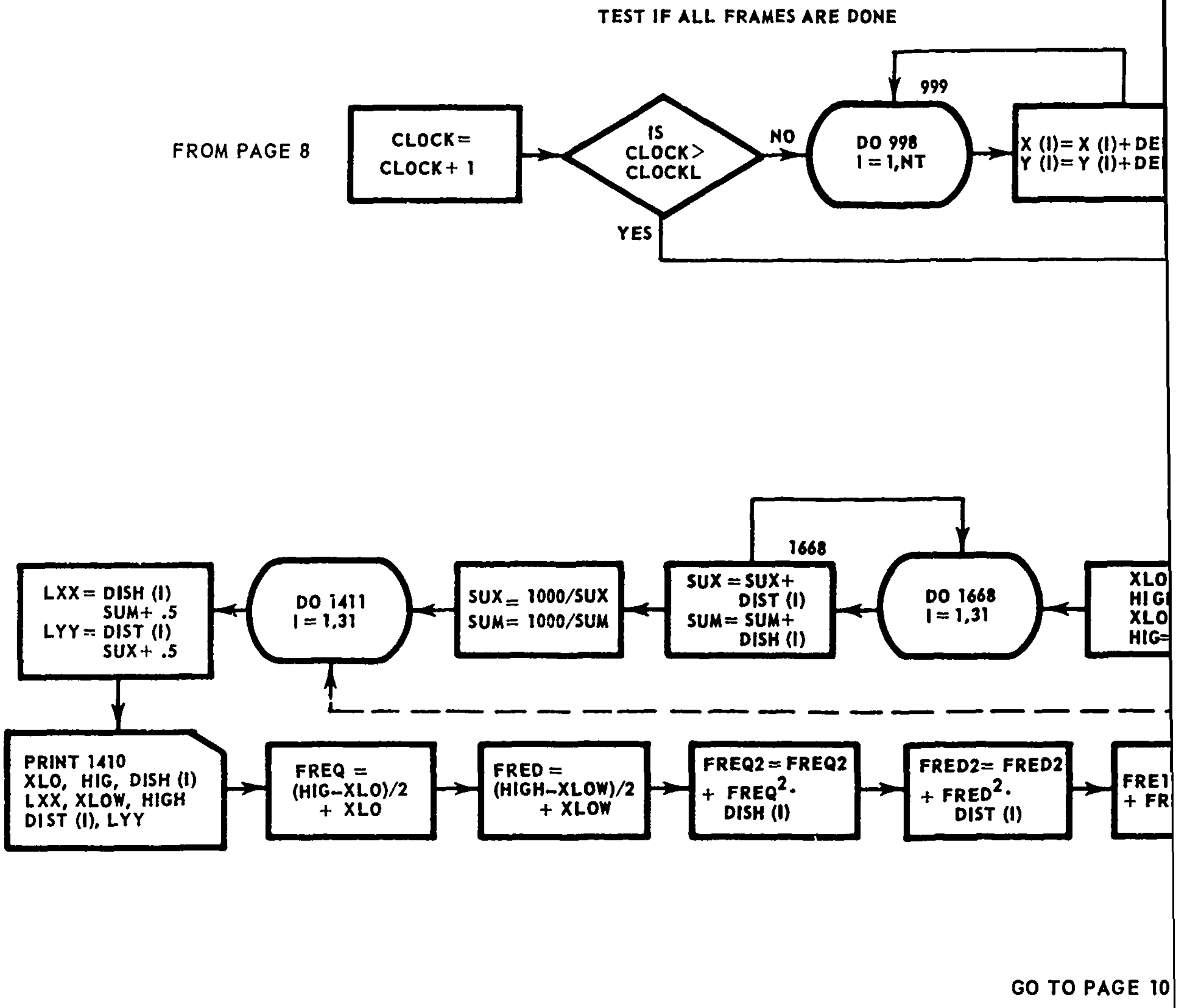


Figure 2-1 (Cont.)

B.


TEST IF ALL FRAMES ARE DONE
FROM PAGE 8
CLOCK= CLOCK+ 1
IS CLOCK> CLOCKL
NO
YES
999
DO 998 I = 1,NT
X (I)= X (I)+DE
Y (I)= Y (I)+DE
1668
LXX= DISH (I) SUM+ .5
LYY= DIST (I) SUX+ .5
DO 1411 I = 1,31
SUX= 1000/SUX
SUM= 1000/SUM
SUX = SUX+ DIST (I)
SUM= SUM+ DISH (I)
DO 1668 I= 1,31
XLO
HIG
XLO
HIG=
PRINT 1410 XLO, HIG, DISH (I) LXX, XLOW, HIGH DIST (I), LYY
FREQ = (HIG-XLO)/2 + XLO
FRED = (HIGH-XLOW)/2 + XLOW
FREQ2= FREQ2 + FREQ^2· DISH (I)
FRED2= FRED2 + FRED^2· DIST (I)
FRE1
+ FR
GO TO PAGE 10

A,

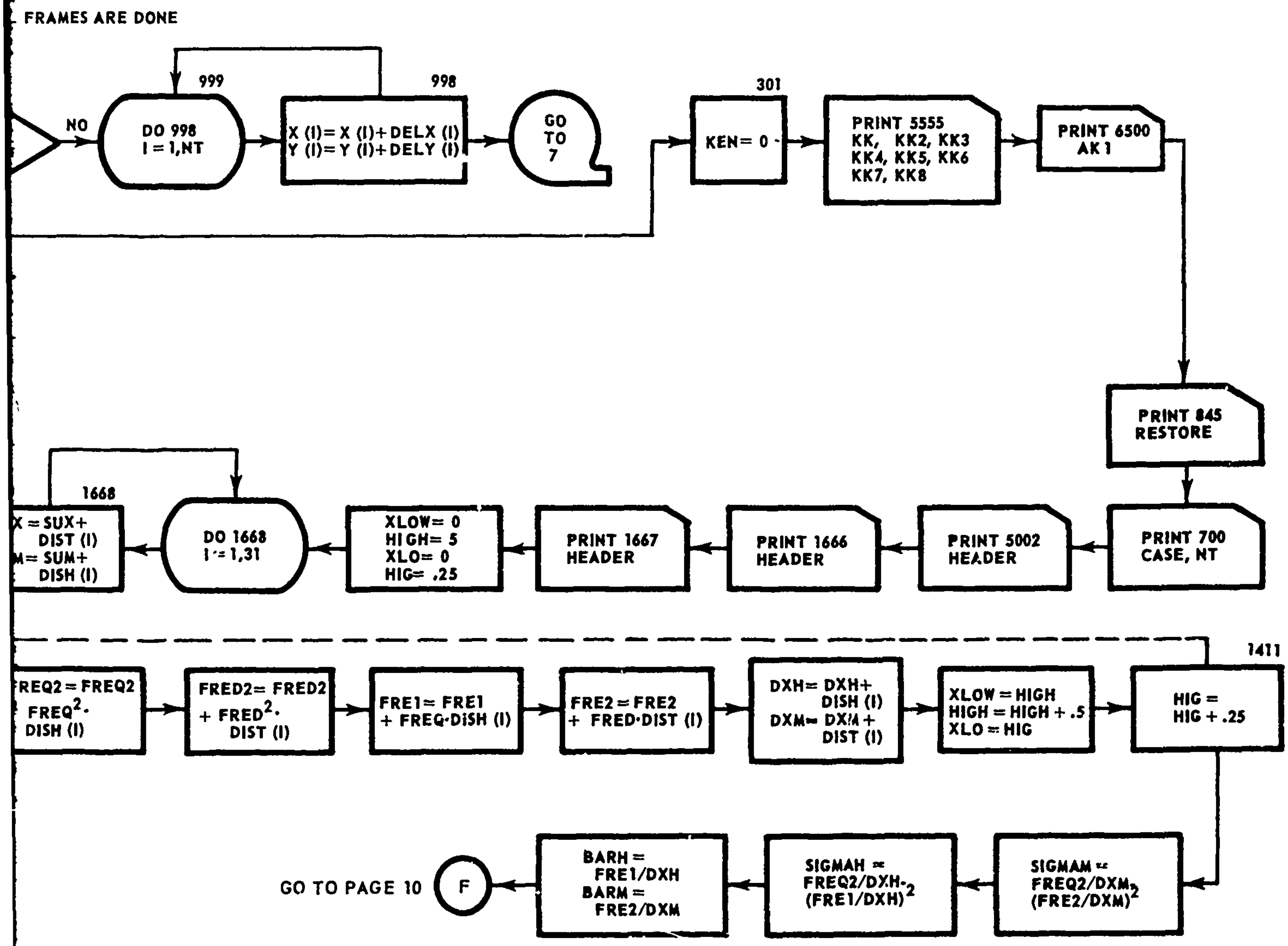
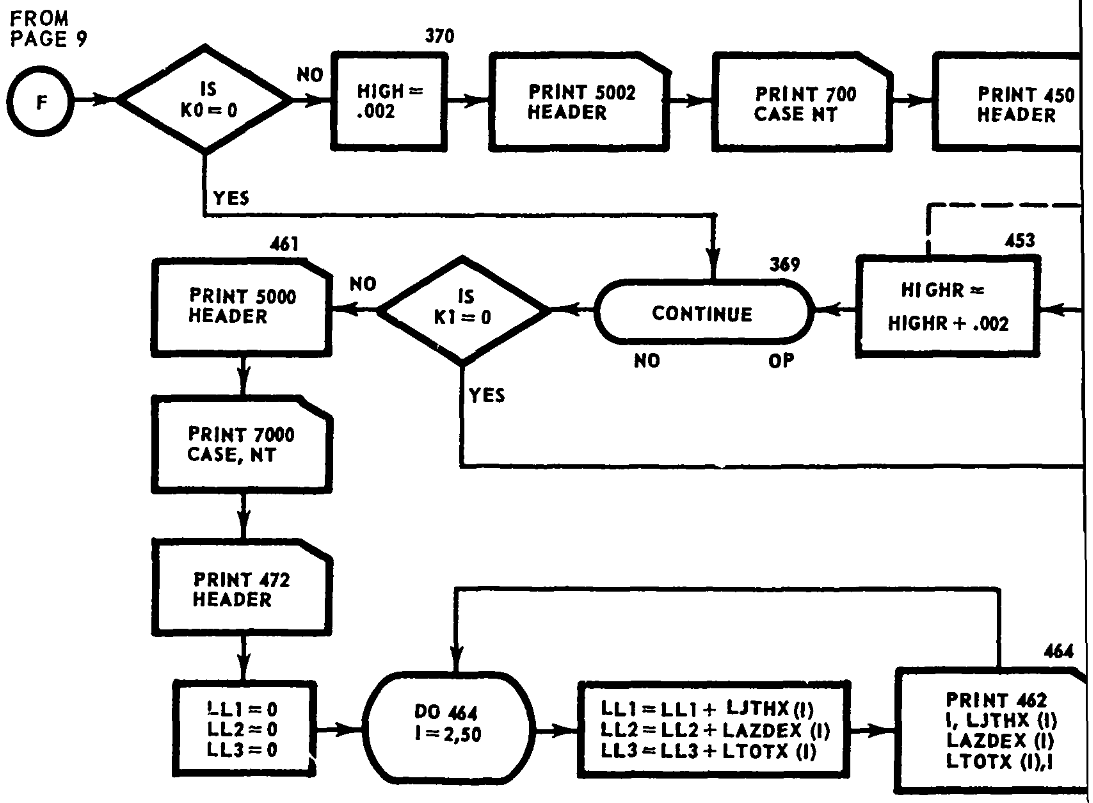


Figure 2-1 (Cont.)

B.


FROM PAGE 9
F
IS K0 = 0
NO
YES
370
HIGH = .002
PRINT 5002 HEADER
PRINT 700 CASE NT
PRINT 450 HEADER
453
HIGHR = HIGHR + .002
369
CONTINUE
NO
OP
IS K1 = 0
NO
YES
461
PRINT 5000 HEADER
PRINT 7000 CASE, NT
PRINT 472 HEADER
LL1 = 0
LL2 = 0
LL3 = 0
DO 464 I = 2,50
LL1 = LL1 + LJTHX (I)
LL2 = LL2 + LAZDEX (I)
LL3 = LL3 + LTOTX (I)
464
PRINT 462 I, LJTHX (I) LAZDEX (I) LTOTX (I),I

Fi

A.

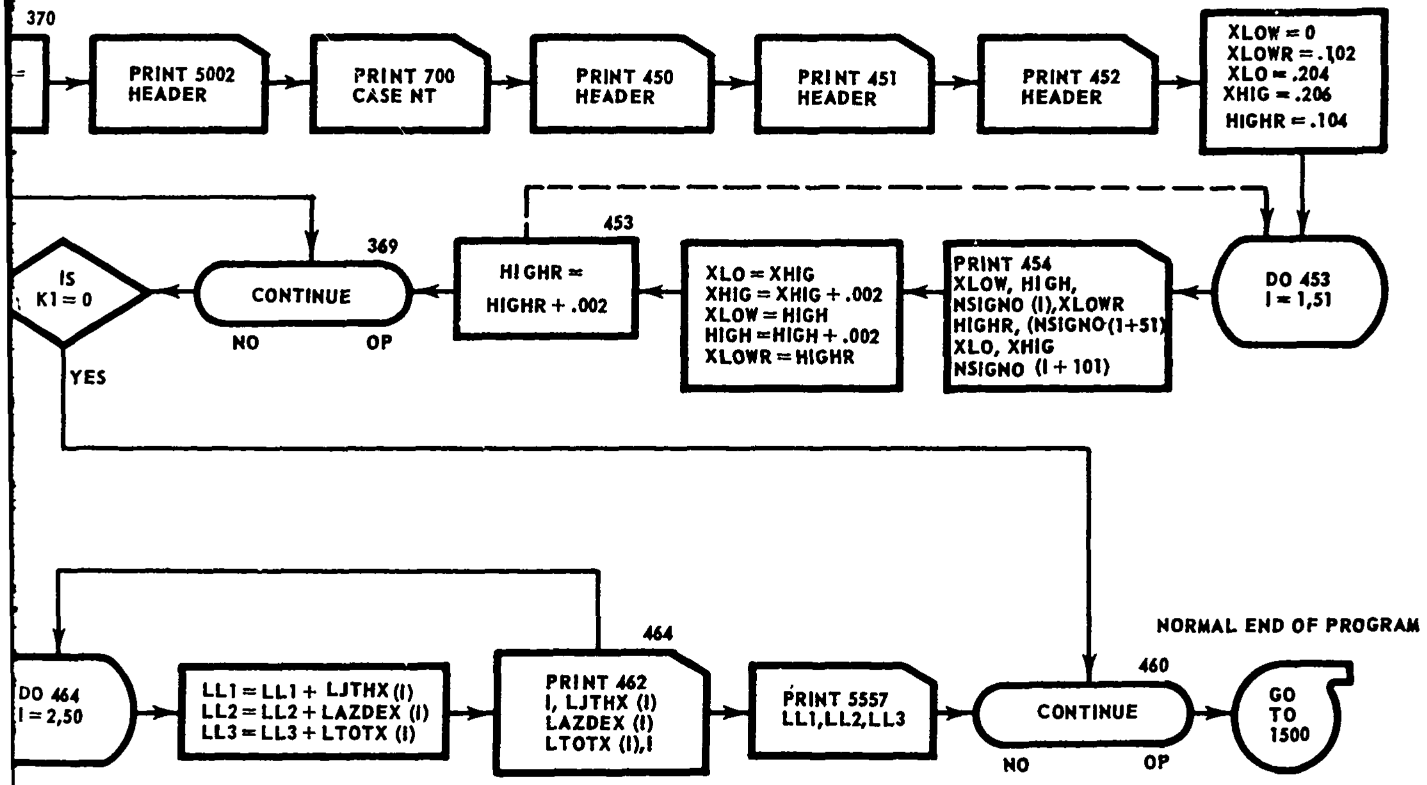


Figure 2-1 (Cont.)

B.

2.2 ENVIRONMENT GENERATOR MODIFICATION FOR MANEUVERING TARGETS

2.2.1 Glossary

ALPHA 1	The target heading measured from due East counter clockwise to the tail of the target direction line (Northbound = 180°, Southbound = 0°, etc.)
ALT	Altitude of target
ANGLE	The angle used to calculate the new target position after the target has turned through θ degrees
BETA	Angle of bank for a specific target turn
CHORD	The length of the straight line connecting two points of the flight path of a specific target
CID	Curve identification. CID = 0 implies a turn to the right, CID = 1 implies a left turn
CLOCK	Identification number (outputed) for each set of target positions
G	Force acting on a target during turn due to gravity (commonly referred to as g-loading)
HEAD	Flight direction of target recorded as the angle measured in degrees from due North (compass North), clockwise to the front of the direction line of the target. (North bound = 0°, Southbound = 180°, etc.)
I	Index for frame loop
ITAG	Target flight plan control. This parameter keeps track of where each target is with respect to its flight plan
J	Target index

M	A counter used to permit the program to run 30 frames before commencing a test for out of range boundaries on the targets
N	Subscript for flight leg identification
NF	Number of frames. When NF is entered as zero the program runs until all the targets are out of radar range. (Since NF is a "DO LOOP Limit" the program must transfer around the respective LOOP when NF = 0.) When NF > 0 the program stops after NF frames (radar revolutions)
NT	Number of targets; NT at present is set for a maximum of 60 targets
NTOR	Number of targets out of radar range
RATETN	Angular rate of turn in radians for a specific target and a specific turn
SEC	Number of seconds target is to fly in a specific turn
SECST	Number of seconds target is to fly in a specific straight course
THETA	The angle a target must turn to complete a frame
THETAL	The angle remaining to be turned through to complete a specific curved course
V	Target velocity
X	X coordinate target position
XLAST	X coordinate target position
XPART	The X distance remaining to travel in order to finish either a straight line course, or a curved course
Y	Y coordinate target position
YLAST	Y coordinate target position
YPART	The Y distance remaining to travel in order to finish either a straight line course or a curved course

2.2.2 Environment Generator FORTRAN Listing

```
      DIMENSION V(60),X(60),Y(60),ALT(60),SECST(5,60),SEC(5,60),HEAD(5,6
     X0),G(5,60),CID(5,60),ITAG(60),                    XLAST(60),YLAST
     X(60), BETA(5,60), RMAX(60),RMIN(60),RMIN2(60), RATETN(5,60)
      DIMENSION THETA(60), CHORD(60), ANGLE(60), ALPHA1(60), THETA1(60)
      EQUIVALENCE(BETA,G)
      EQUIVALENCE(ALPHA1,HEAD)
      READ 10,NT,NF,ID
      WRITE OUTPUT TAPE 2,10,NT,NF,ID
   10 FORMAT(3I5)
      DO 14 J=1,NT
      READ 12, (X(J), Y(J), ALT(J), V(J))
   12 FORMAT (4F14.4)
      READ 16, SECST(1,J), HEAD(1,J), G(1,J), SECST( 2 ,J), HEAD( 2 ,J),
     X G( 2 ,J),  CID(1,J),  CID( 2 ,J)
      READ 16,SECST(3,J),HEAD(3,J),G(3,J),SECST(4,J),HEAD(4,J),G(4,J),
     X CID( 3,J), CID(4,J),SECST(5,J),HEAD(5,J)
   16 FORMAT(2F9.3,F7.3  ,2F9.3,F7.3,2F2.0,2F9.3)
      IF (SENSE SWITCH1)300,14
  300 PRINT302
  302 FORMAT(55H0DATA LISTED BELOW IS INPUTS ARRANGED AS IN INPUTFORMAT)
      PRINT303,X(J),Y(J),ALT(J),V(J)
      PRINT304,SECST(1,J),HEAD(1,J),G(1,J),SECST(2,J),HEAD(2,J),G(2,J
     1 CID(1,J),CID(2,J)
      PRINT304,SFCST(3,J),HEAD(3,J),G(3,J),SECST(4,J),HEAD(4,J),G(4,J),
     1 CID(3,J),CID(4,J),SECST(5,J),HEAD(5,J)
  303 FORMAT( 4F16.6)
  304 FORMAT(2F9.3,F7.3,2F9.3,F7.3,2F2.0,2F9.3)
   14 CONTINUE
      N=1
      DO 20 J=1,NT
      HEAD(N,J)=270.-HEAD(N,J)
      ITAG(J)=1
      RMAX(J)= 1.23*SQRTF(ALT(J))
      RMIN(J)= -340.906 +SQRTF((340.906)**2+(9200./6080.)*ALT(J)+(ALT(J)
     X/6080.)**2)
      RMIN2(J)=1./(RMIN(J))**2
      V(J)=V(J)/3600.
      XLAST(J) = X(J)
      YLAST(J) = Y(J)
      IF(SENSE SWITCH1)132,130
  132 PRINT 134,NT,RMAX(J),RMIN(J),RMIN2(J)
  134 FORMAT(5H  NT=I5,6H RMAX=F16.8,6H RMIN=F16.8,7H RMIN2=F16.8)
  130 WRITE OUTPUT TAPE 2,22,RMAX(J),RMIN(J),RMIN2(J)
   22 FORMAT(3E16.8)
   20 CONTINUE
C     CALCULATE NUMBER OF SECONDS IN THE TARGET TURNS PLUS RATE OF TURN
```

```
136 IF(SENSE SWITCH 1) 520,106
520 PRINT 92
 92 FORMAT(30H   BETA      RATETN       SEC   )
106 DO 26 N=1,4
    DO 26 J=1,NT
    BETA(N,J)= ATANF(SQRTF((G(N,J)**2-1.)))
 25 RATETN(N,J)=(SINF(BETA(N,J)))/(188.82*V(J)*COSF(BETA(N,J)))
    HEAD(N+1,J)=270.-HEAD(N+1,J)
    IF(SENSE SWITCH3)400,401
400 PRINT 402,HEAD(N,J)
402 FORMAT(7H HEAD =   F10.3)
401 IF(CID(N,J))200,202,200
202 IF(HEAD(N+1,J)-HEAD(N,J))204,206,206
206 SEC(N,J)=(6.2832-(HEAD(N+1,J)-HEAD(N,J))*.0174533)/RATETN(N,J)
    GO TO 208
204 SEC(N,J)=((HEAD(N,J)-HEAD(N+1,J))*.0174533)/RATETN(N,J)
    GO TO 208
200 IF(HEAD(N+1,J)-HEAD(N,J))210,210,212
210 SEC(N,J)=(6.2832-(HEAD(N,J)-HEAD(N+1,J))*.0174533)/RATETN(N,J)
    GO TO 208
212 SEC(N,J)=(HEAD(N+1,J)-HEAD(N,J))*0.0174533 /RATETN(N,J)
208 IF(SENSE SWITCH 1)86,26
 86 PRINT 88,BETA(N,J),RATETN(N,J),SEC(N,J)
 88 FORMAT(3F10.3)
 26 CONTINUE
     N=1
    CLOCK =0.
    WRITE OUTPUT TAPE 2,501,CLOCK
501 FORMAT(F6.0)
    DO 120 J=1,NT
    ALPHA1(J)=HEAD(N,J)*.0174533
120 WRITE OUTPUT TAPE 2,38,X(J),Y(J)
    NTOR=0
    M=0
    DO 90 I=1,NF
505 CLOCK=CLOCK+1.
    WRITE OUTPUT TAPE 2,501,CLOCK
    DO 80  J=1,NT
    N = ITAG(J)
    IF (SECST(N,J)-15.)34,36,36
 36  SECST(N,J)=SECST(N,J)-15.
    X(J)=XLAST(J)-15.*V(J)*COSF(ALPHA1(J))
    Y(J)=YLAST(J)-15.*V(J)*SINF(ALPHA1(J))
    XLAST(J)=X(J)
    YLAST(J)=Y(J)
    IF(SENSE SWITCH2)94,76
 94 PRINT 96,J,N,SECST(N,J),X(J),Y(J)
 96 FORMAT(8H0 TARGETI2,10HIS ON THE I2,21HST. LINE LEG. IT HAS F8.3,1
   X6HSEC LEFT. XCOOR=F8.3,7H YCOOR=F8.3)
```

```
      GO TO 76
   34 IF(SECST(N,J))40,42,40
   40 XPART=SECST(N,J)*V(J)*COSF(ALPHA1(J))
      YPART=SECST(N,J)*    V(J)*SINF(ALPHA1(J))
   42 IF(ITAG(J)-5)44,46,44
   46 PRINT 48,J
   48 FORMAT(11H TARGET NO I2,32H IS TRYING TO ENTER A 5TH CURVE.)
      PAUSE 7
   44 IF( SEC(N,J)-15.+SECST(N,J)) 50,52,52
   52 SEC(N,J)= SEC(N,J)-15.+SECST(N,J)
      THETA(  J) =  (15.-SECST(N,J))*RATETN(N,J)
      SECST(N,J)=0
      XLAST(J) = X    (J)-XPART
      YLAST(J)=Y(J)-YPART
      CHORD(J)=(2.*V(J)*SINF(THETA(J)/2.))/RATETN(N,J)
         TARGET TO TURN CLOCKWISE OR COUNTER-CLOCKWISE
      IF(CID(N,J))54,56,54
   56 ANGLE(J)=THETA(J)/2.+1.570797-ALPHA1(J)
      ALPHA1(J)=ALPHA1(J)-THETA(J)
      IF(ALPHA1(J))220,218,218
  220 ALPHA1(J)=6.2832+ALPHA1(J)
      GO TO 218
   54 ANGLE(J)=1.570797-THETA(J)/2.-ALPHA1(J)
      ALPHA1(J)=ALPHA1(J)+THETA(J)
      IF(ALPHA1(J)-6.2832)218,218,214
  214 ALPHA1(J)=ALPHA1(J)-6.2832
  218 X(J)=XLAST(J)-CHORD(J)*SINF(ANGLE(J))
      Y(J)=YLAST(J)-CHORD(J)*COSF(ANGLE(J))
      XLAST(J)=X(J)
      YLAST(J)=Y(J)
      IF (SENSE SWITCH 2)98,76
   98 PRINT 100,J,N, SEC(N,J),CID(N,J)
  100 FORMAT'9H0 TARGET I2,11HHAS ENTEREDI2,19HCURVED LEG. IT HAS F8.3,1
     XOHSEC. LEFT.,8H    CID=F2.0)
      PRINT 102,XLAST(J),YLAST(J)
  102 FORMAT(12H0LAST POINT=2F10.3)
      PRINT 104,THETA(J),CHORD(J),ANGLE(J),ALPHA1(J),X(J),Y(J)
  104 FORMAT(8H  THETA=F10.3,7H CHORD=F10.3,7H ANGLE=F10.3 7H ALPHA1=F10
     X.3,7H XCOOR=F10.3,7H YCOOR=F10.3 )
      GO TO 76
   50 IF(SEC(N,J))60,62,60
   60 THETA1(  J)= SEC(N,J)* RATETN(N,J)
      IF(CID(N,J)) 64,66,64
   66 ANGLE(J)=THETA1(J)/2.+1.5707965-ALPHA1(J)
      ALPHA1(J)=ALPHA1(J)-THETA1(J)
      IF(ALPHA1(J))224,68,68
  224 ALPHA1(J)=6.2832+ALPHA1(J)
      GO TO 68
   64  ANGLE(  J)= 1.5707965 - THETA1(  J)/2. -ALPHA1(  J)
```

```
      ALPHA1(J)=ALPHA1(J)+THETA1(J)
      IF(ALPHA1(J)-6.2832)68,68,228
  228 ALPHA1(J)=ALPHA1(J)-6.2832
   68 CHORD(J)=2.*V(J)*SINF(THETA1(J)/2.)/RATETN(N,J)
      XPART=XPART+CHORD(J)*SINF(ANGLE(J))
      YPART=YPART+CHORD(J)*COSF(ANGLE(J))
      ITAG(J)= ITAG(J)+1
      XLAST(J)=X(J)-XPART
      YLAST(J)=Y(J)-YPART
      N= ITAG(J)
      SECST(N,J)=SECST(N,J)-15.+SEC(N-1,J)+SECST(N-1,J)
      GO TO 70
   62 ITAG(J) = ITAG(J)+1
      N= ITAG(J)
   70 X(J)=XLAST(J)-(15.-SEC(N-1,J)-SECST(N-1,J))*V(J;*COSF(ALPHA1(J))
      Y(J)=YLAST(J)-(15.-SEC(N-1,J)-SECST(N-1,J))*V(J)*SINF(ALPHA1(J))
      SEC(N-1,J)=0
      IF(SENSE SWITCH 2)108,76
  108 PRINT 110,J,N
  110 FORMAT(8H TARGET I2,15HHAS ENTERED THEI2,13HST. LINE LEG. )
      PRINT112,XPART,YPART,ALPHA1(J),CHORD(J),XLAST(J),YLAST(J)
  112 FORMAT(8H  XPART=F8.3,8H  YPART=F8.3,9H  ALPHA1=F8.3,7H CHORD=F8.3
     X,7H XLAST=F8.3,7H YLAST=F8.3)
   76 XLAST(J)=X(J)
      YLAST(J)=Y(J)
      XPART=0
      YPART=0
      IF(SENSE SWITCH1)138,140
  138 PRINT310,X(J),Y(J)
  310 FORMAT(2F16.8)
  140 WRITE OUTPUT TAPE 2,38,X(J),Y(J)
   38 FORMAT(2E16.8)
      IF(M-30)80,508,508
  508 IF(Y(J)-500.)509,509,510
  510 IF(SQRTF((X(J)-500.)**2+(Y(J)-500.)**2)-RMAX(J)) 80,509,509
  509 NTOR=NTOR+1
      IF(NTOR-NT)80,513,513
   80 CONTINUE
      IF(NF)90,516,90
  516 NTOR=0
      M=M+1
      GO TO 505
   90 CONTINUE
  513 CLOCK=-CLOCK
      WRITE OUTPUT TAPE 2,501,CLOCK
      PRINT 330
  330 FORMAT(52H NORMAL FRAME HALT REACHED. SAVE INFO. THANKS  ROD     )
      PAUSE1
      END(0,1,0,0,1 )
```

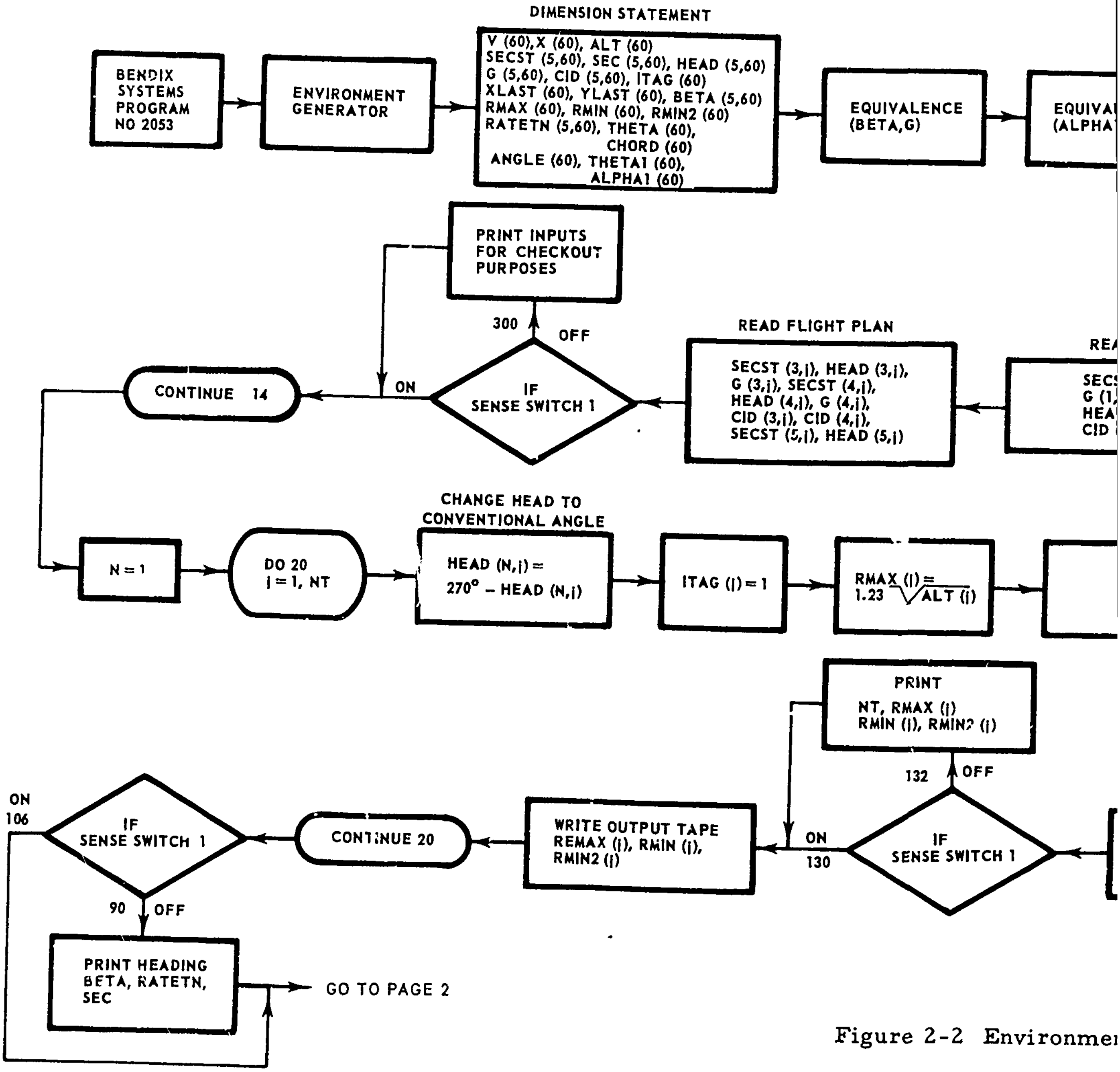


Figure 2-2 Environme

A,

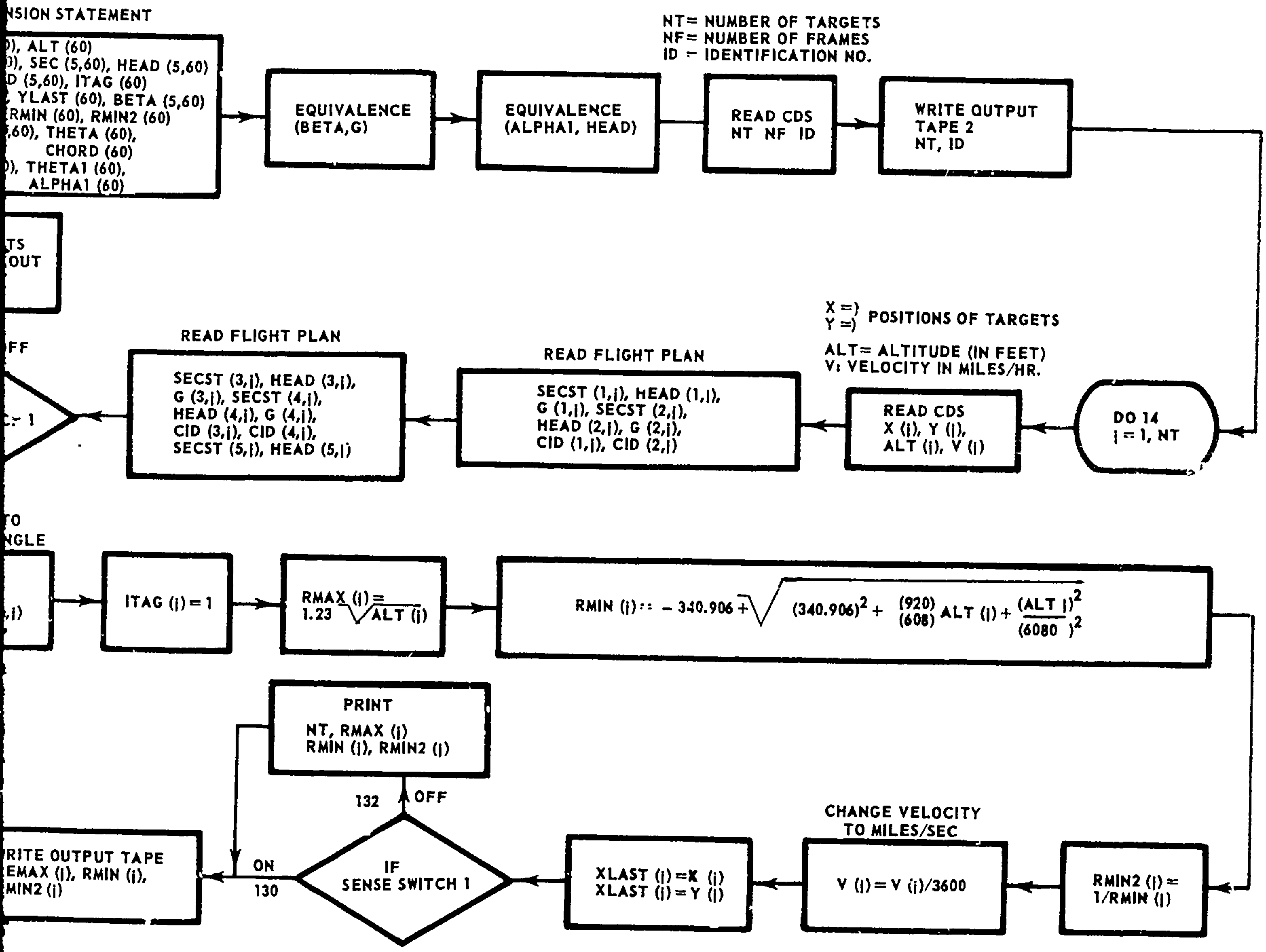
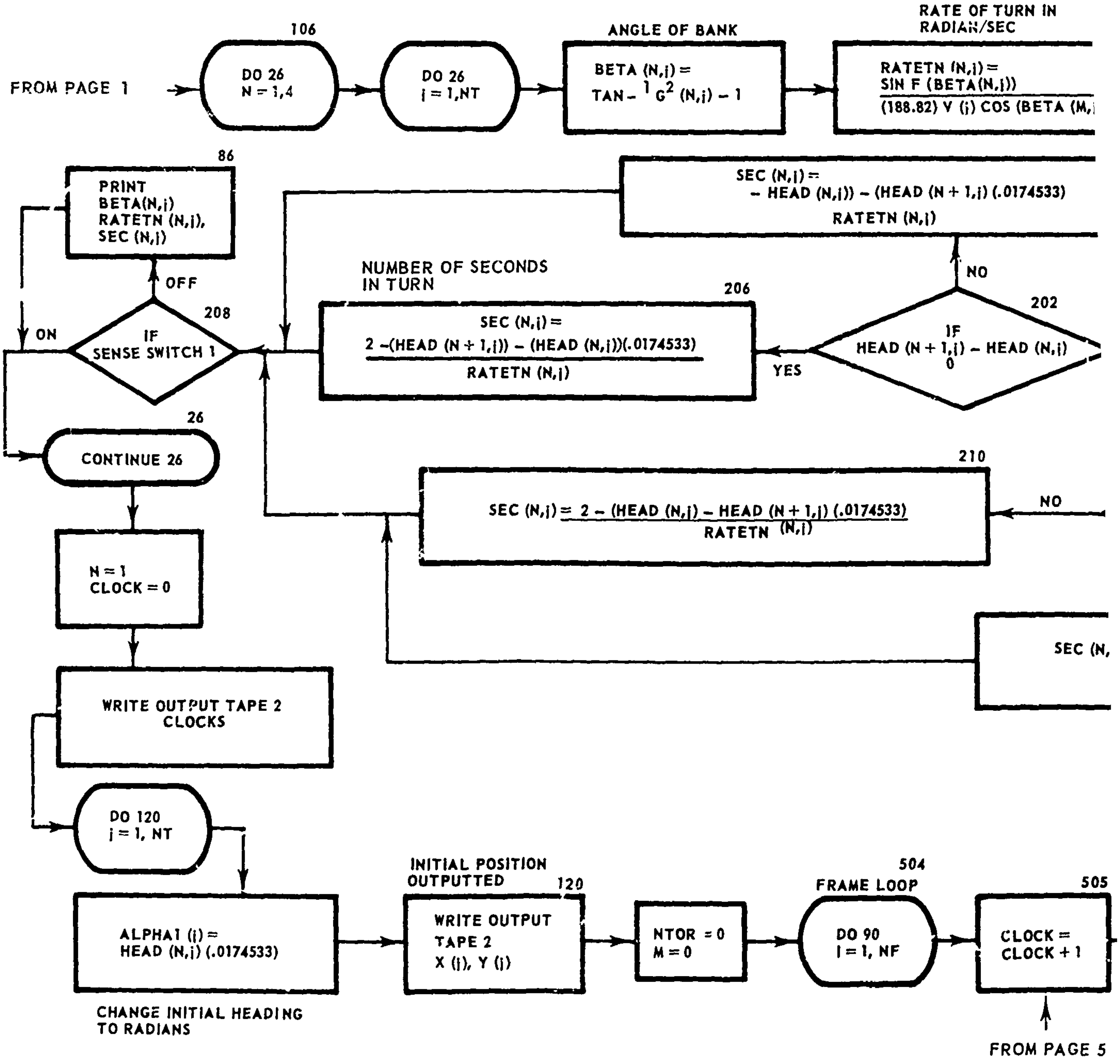


Figure 2-2 Environment Generator Modification Program Flow

B.


FROM PAGE 1
106
DO 26
N = 1,4
DO 26
j = 1,NT
ANGLE OF BANK
BETA (N,j) =
TAN-¹ G² (N,j) - 1
RATE OF TURN IN
RADIAN/SEC
RATETN (N,j) =
SIN F (BETA(N,j))
(188.82) V (j) COS (BETA (M,
86
PRINT
BETA(N,j)
RATETN (N,j),
SEC (N,j)
SEC (N,j) =
- HEAD (N,j)) - (HEAD (N + 1,j) (.0174533)
RATETN (N,j)
OFF
ON
208
IF
SENSE SWITCH 1
NUMBER OF SECONDS
IN TURN
206
SEC (N,j) =
2 -(HEAD (N + 1,j)) - (HEAD (N,j))(.0174533)
RATETN (N,j)
NO
202
IF
HEAD (N + 1,j) - HEAD (N,j)
0
YES
26
CONTINUE 26
210
SEC (N,j) = 2 - (HEAD (N,j) - HEAD (N + 1,j) (.0174533)
RATETN (N,j)
NO
N = 1
CLOCK = 0
SEC (N,
WRITE OUTPUT TAPE 2
CLOCKS
DO 120
j = 1, NT
INITIAL POSITION
OUTPUTTED
120
504
FRAME LOOP
505
ALPHA1 (j) =
HEAD (N,j) (.0174533)
WRITE OUTPUT
TAPE 2
X (j), Y (j)
NTOR = 0
M = 0
DO 90
I = 1, NF
CLOCK =
CLOCK + 1
CHANGE INITIAL HEADING
TO RADIANS
FROM PAGE 5

Figure

A1

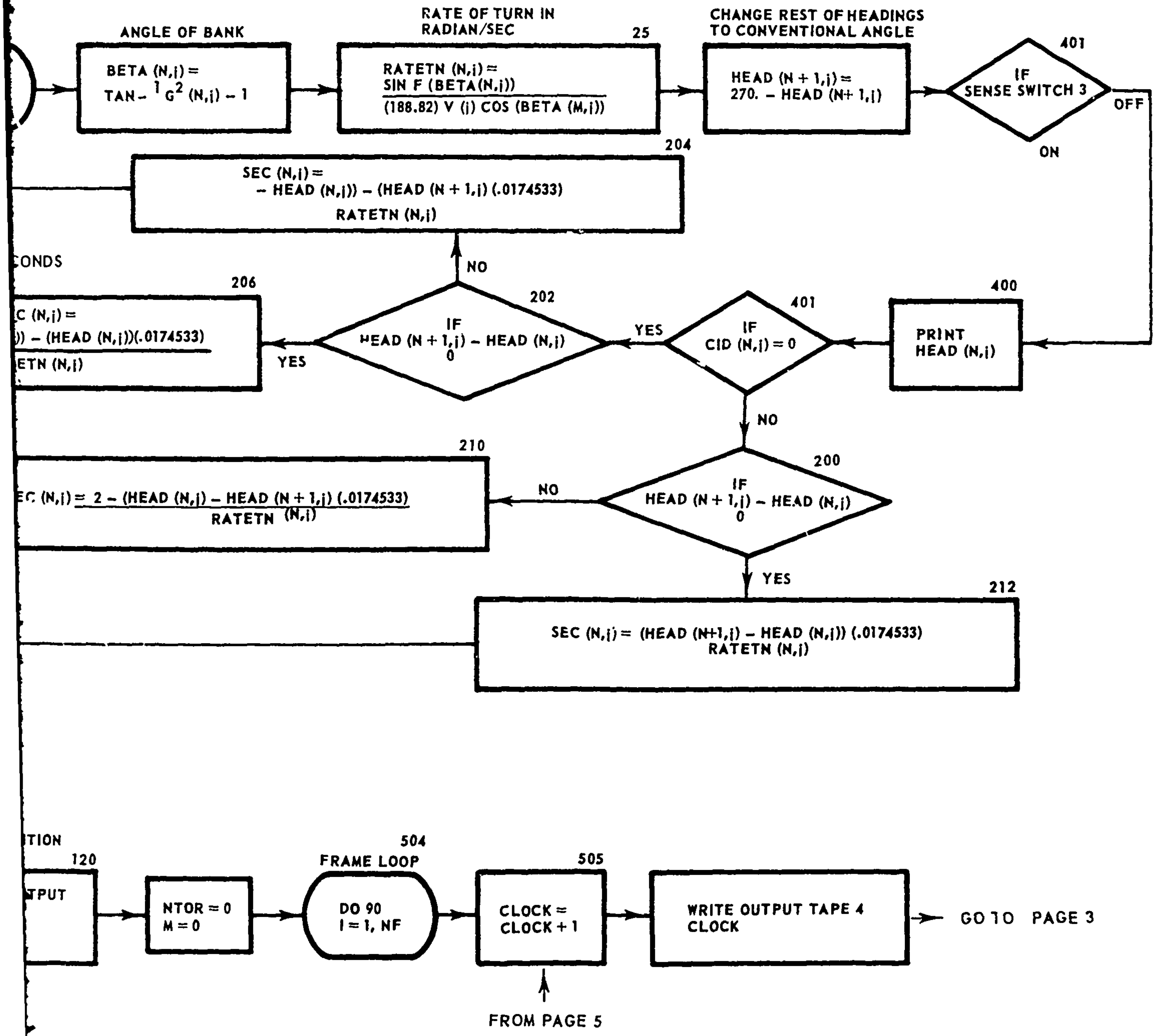
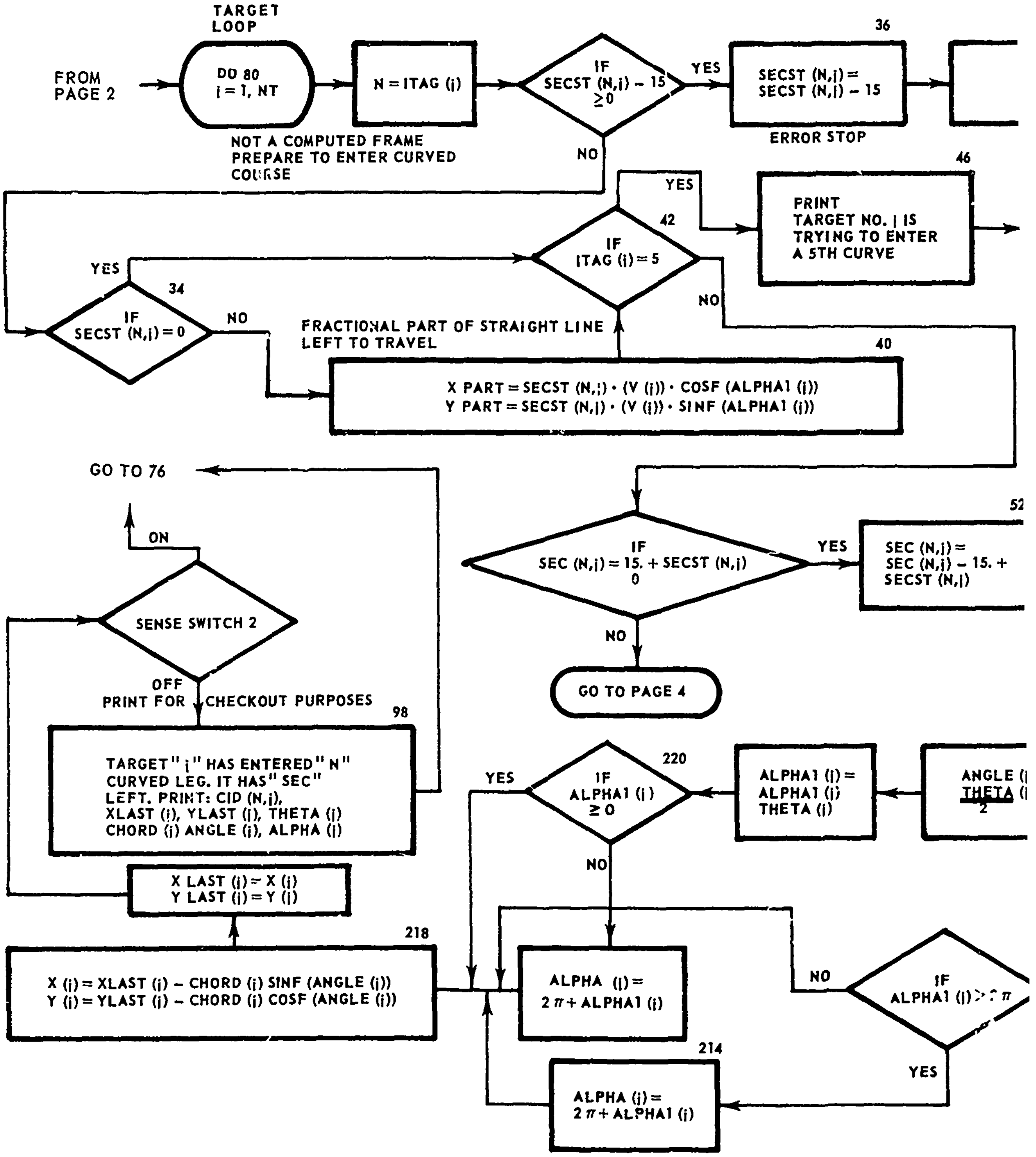

ANGLE OF BANK
BETA (N,j) = TAN- 1 G2 (N,j) - 1
RATE OF TURN IN RADIAN/SEC
25
RATETN (N,j) = SIN F (BETA(N,j)) / (188.82) V (j) COS (BETA (M,j))
CHANGE REST OF HEADINGS TO CONVENTIONAL ANGLE
HEAD (N + 1,j) = 270. - HEAD (N+ 1,j)
401
IF SENSE SWITCH 3
OFF
ON
204
SEC (N,j) = - HEAD (N,j)) - (HEAD (N + 1,j) (.0174533) RATETN (N,j)
ONDS
206
C (N,j) =)) - (HEAD (N,j))(.0174533) ETN (N,j)
YES
NO
202
IF HEAD (N + 1,j) - HEAD (N,j) 0
YES
401
IF CID (N,j) = 0
400
PRINT HEAD (N,j)
NO
210
EC (N,j) = 2 - (HEAD (N,j) - HEAD (N + 1,j) (.0174533) / RATETN (N,j)
NO
200
IF HEAD (N + 1,j) - HEAD (N,j) 0
YES
212
SEC (N,j) = (HEAD (N+1,j) - HEAD (N,j)) (.0174533) RATETN (N,j)
TION
120
TPUT
NTOR = 0 M = 0
504
FRAME LOOP
DO 90 I = 1, NF
505
CLOCK = CLOCK + 1
FROM PAGE 5
WRITE OUTPUT TAPE 4 CLOCK
GO TO PAGE 3

Figure 2-2 (Cont.)

B.


TARGET LOOP
FROM PAGE 2
DO 80
j = 1, NT
N = ITAG (j)
IF SECST (N,j) – 15 ≥ 0
YES
36
SECST (N,j) = SECST (N,j) – 15
ERROR STOP
NOT A COMPUTED FRAME PREPARE TO ENTER CURVED COURSE
NO
YES
46
PRINT TARGET NO. j IS TRYING TO ENTER A 5TH CURVE
42
IF ITAG (j) = 5
NO
YES
34
IF SECST (N,j) = 0
NO
FRACTIONAL PART OF STRAIGHT LINE LEFT TO TRAVEL
40
X PART = SECST (N,j) · (V (j)) · COSF (ALPHA1 (j))
Y PART = SECST (N,j) · (V (j)) · SINF (ALPHA1 (j))
GO TO 76
ON
SENSE SWITCH 2
OFF
PRINT FOR CHECKOUT PURPOSES
98
TARGET "j" HAS ENTERED "N" CURVED LEG. IT HAS "SEC" LEFT. PRINT: CID (N,j), XLAST (j), YLAST (j), THETA (j) CHORD (j) ANGLE (j), ALPHA (j)
X LAST (j) = X (j)
Y LAST (j) = Y (j)
218
X (j) = XLAST (j) – CHORD (j) SINF (ANGLE (j))
Y (j) = YLAST (j) – CHORD (j) COSF (ANGLE (j))
52
IF SEC (N,j) = 15. + SECST (N,j) 0
YES
SEC (N,j) = SEC (N,j) – 15. + SECST (N,j)
NO
GO TO PAGE 4
220
YES
IF ALPHA1 (j) ≥ 0
ALPHA1 (j) = ALPHA1 (j) THETA (j)
ANGLE (j
THETA (j
2
NO
ALPHA (j) = 2π + ALPHA1 (j)
NO
IF ALPHA1 (j) > 2π
214
YES
ALPHA (j) = 2π + ALPHA1 (j)

A1

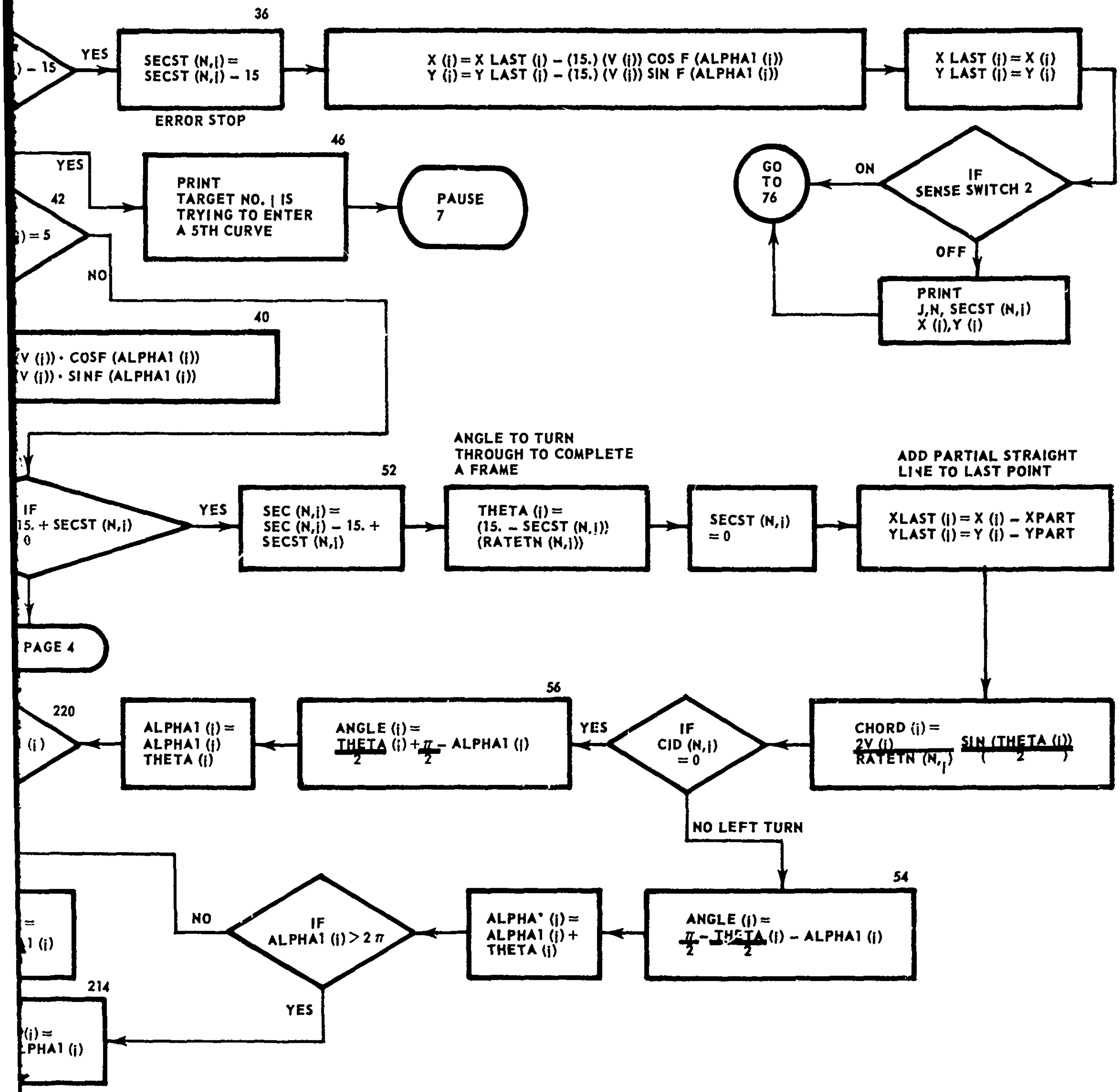
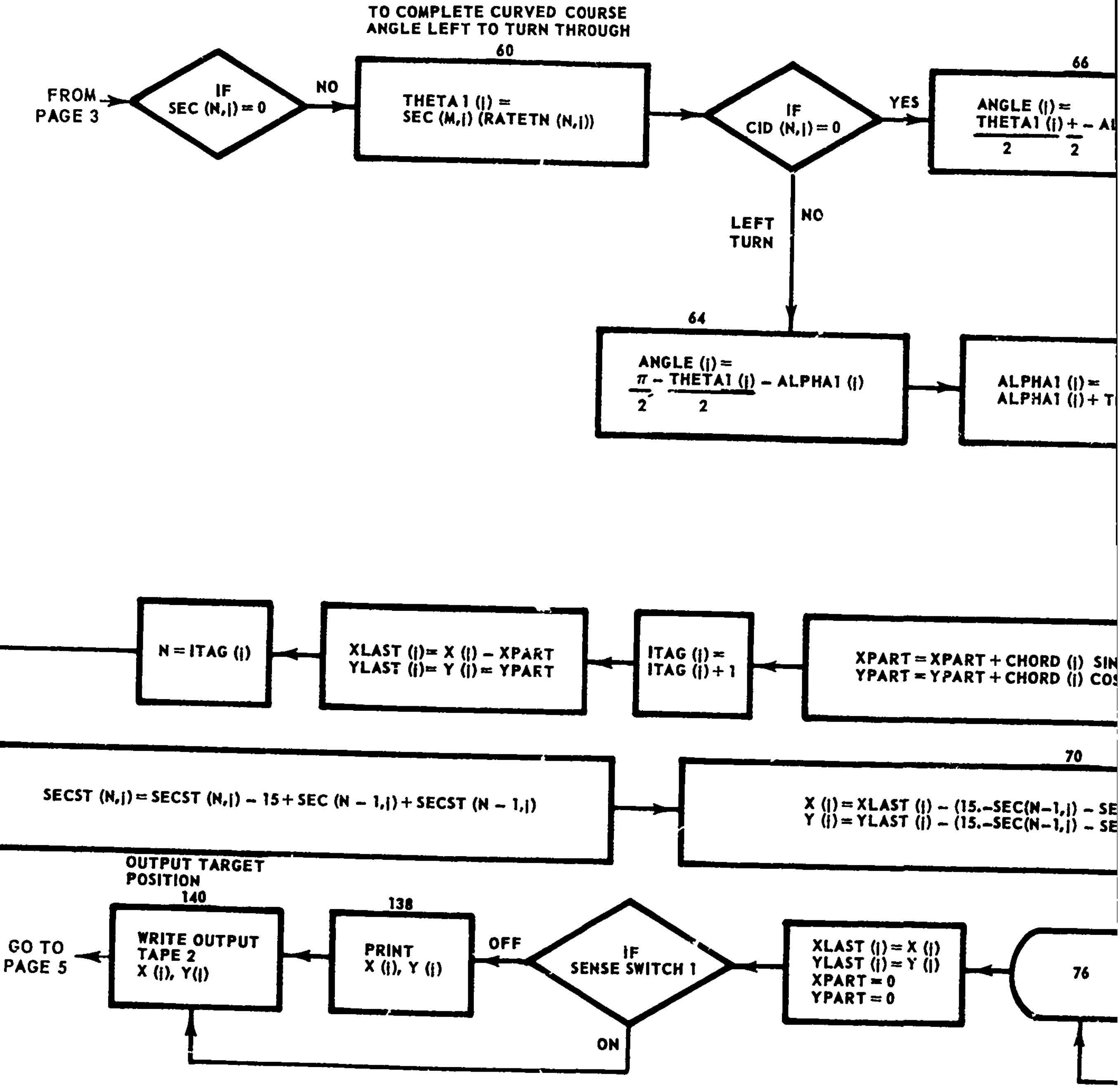


Figure 2-2 (Cont.)


TO COMPLETE CURVED COURSE
ANGLE LEFT TO TURN THROUGH
60
FROM PAGE 3
IF SEC (N,J) = 0
NO
THETA 1 (J) = SEC (M,J) (RATETN (N,J))
IF CID (N,J) = 0
YES
66
ANGLE (J) = THETA1 (J)/2 + - AL
2
LEFT TURN
NO
64
ANGLE (J) = π/2 - THETA1 (J)/2 - ALPHA1 (J)
ALPHA1 (J) = ALPHA1 (J) + T
N = ITAG (J)
XLAST (J) = X (J) - XPART
YLAST (J) = Y (J) = YPART
ITAG (J) = ITAG (J) + 1
XPART = XPART + CHORD (J) SIN
YPART = YPART + CHORD (J) COS
SECST (N,J) = SECST (N,J) - 15 + SEC (N - 1,J) + SECST (N - 1,J)
70
X (J) = XLAST (J) - (15.-SEC(N-1,J) - SE
Y (J) = YLAST (J) - (15.-SEC(N-1,J) - SE
OUTPUT TARGET POSITION
140
WRITE OUTPUT TAPE 2 X (J), Y(J)
138
PRINT X (J), Y (J)
OFF
IF SENSE SWITCH 1
ON
XLAST (J) = X (J)
YLAST (J) = Y (J)
XPART = 0
YPART = 0
76
GO TO PAGE 5

Fi

A,

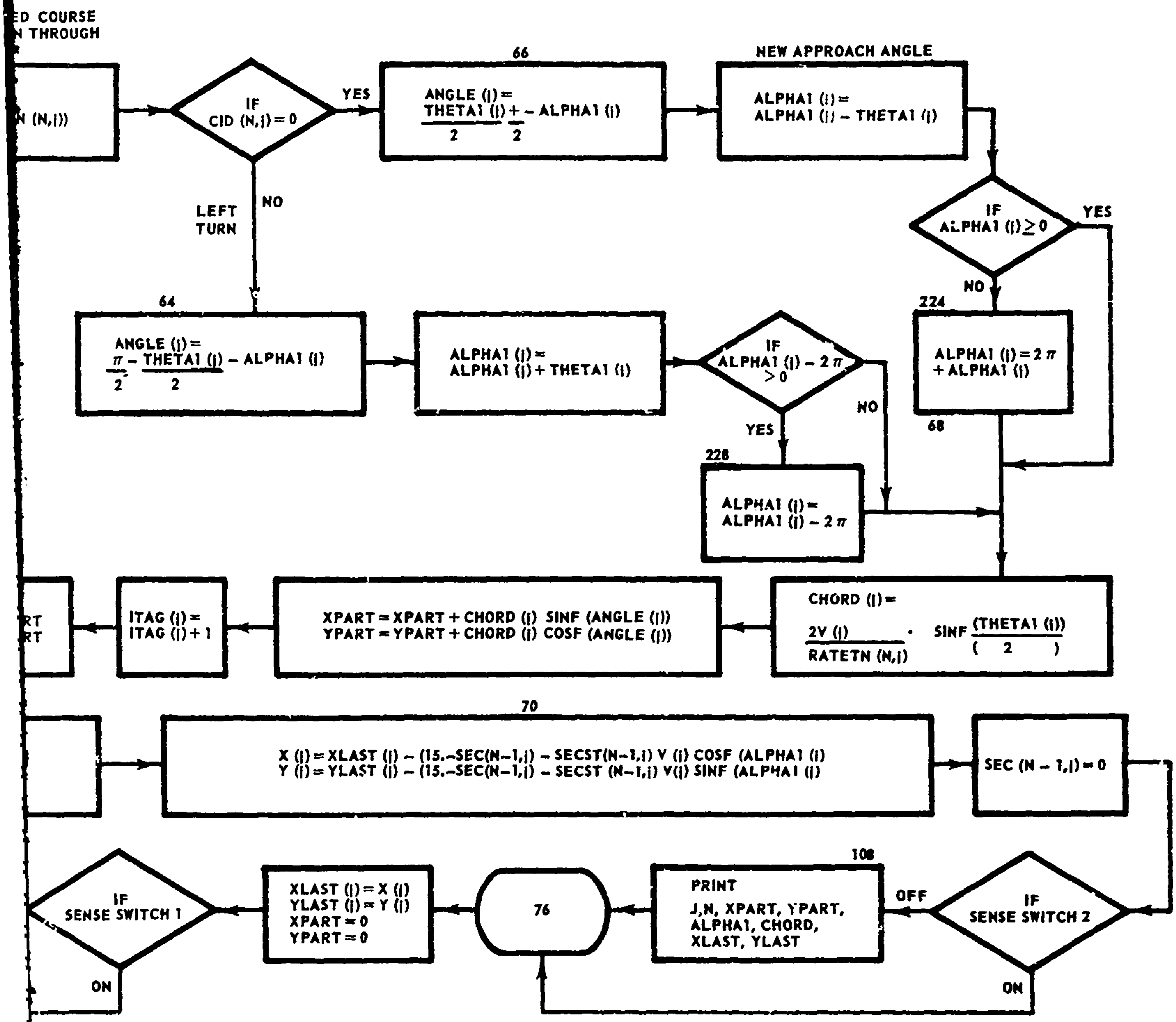
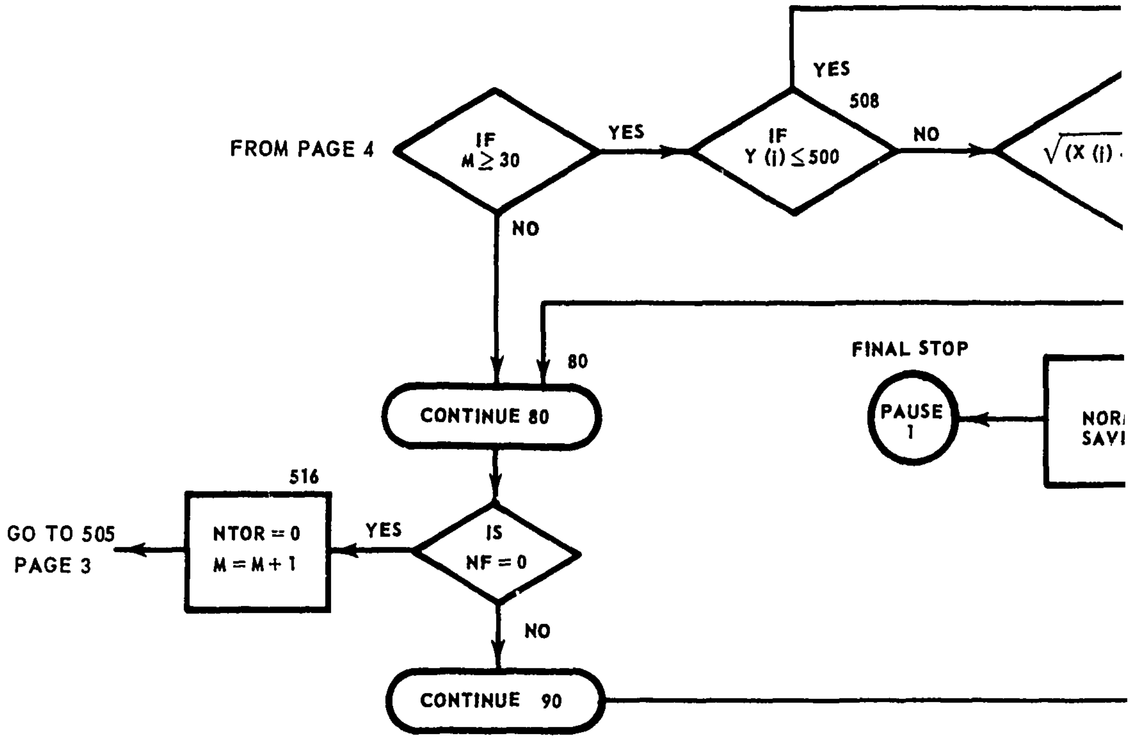

ED COURSE
N THROUGH
N (N,J))
IF CID (N,J) = 0
YES
NO
LEFT TURN
66
ANGLE (J) = THETA1 (J)/2 + π/2 – ALPHA1 (J)
NEW APPROACH ANGLE
ALPHA1 (J) = ALPHA1 (J) – THETA1 (J)
IF ALPHA1 (J) ≥ 0
YES
NO
224
ALPHA1 (J) = 2 π + ALPHA1 (J)
68
64
ANGLE (J) = π/2 – THETA1 (J)/2 – ALPHA1 (J)
ALPHA1 (J) = ALPHA1 (J) + THETA1 (J)
IF ALPHA1 (J) – 2 π > 0
YES
NO
228
ALPHA1 (J) = ALPHA1 (J) – 2 π
CHORD (J) = 2V (J)/RATETN (N,J) · SINF (THETA1 (J)/2)
XPART = XPART + CHORD (J) SINF (ANGLE (J))
YPART = YPART + CHORD (J) COSF (ANGLE (J))
ITAG (J) = ITAG (J) + 1
RT
RT
70
X (J) = XLAST (J) – (15.–SEC(N–1,J) – SECST(N–1,J) V (J) COSF (ALPHA1 (J)
Y (J) = YLAST (J) – (15.–SEC(N–1,J) – SECST (N–1,J) V(J) SINF (ALPHA1 (J)
SEC (N – 1,J) = 0
IF SENSE SWITCH 2
OFF
ON
108
PRINT
J,N, XPART, YPART, ALPHA1, CHORD, XLAST, YLAST
76
XLAST (J) = X (J)
YLAST (J) = Y (J)
XPART = 0
YPART = 0
IF SENSE SWITCH 1
ON

Figure 2-2 (Cont.)

B


FROM PAGE 4
IF
M ≥ 30
YES
NO
YES
508
IF
Y (I) ≤ 500
NO
√(X (I) ·
80
FINAL STOP
CONTINUE 80
PAUSE
1
NOR
SAVI
516
GO TO 505
PAGE 3
NTOR = 0
M = M + 1
YES
IS
NF = 0
NO
CONTINUE 90

A1

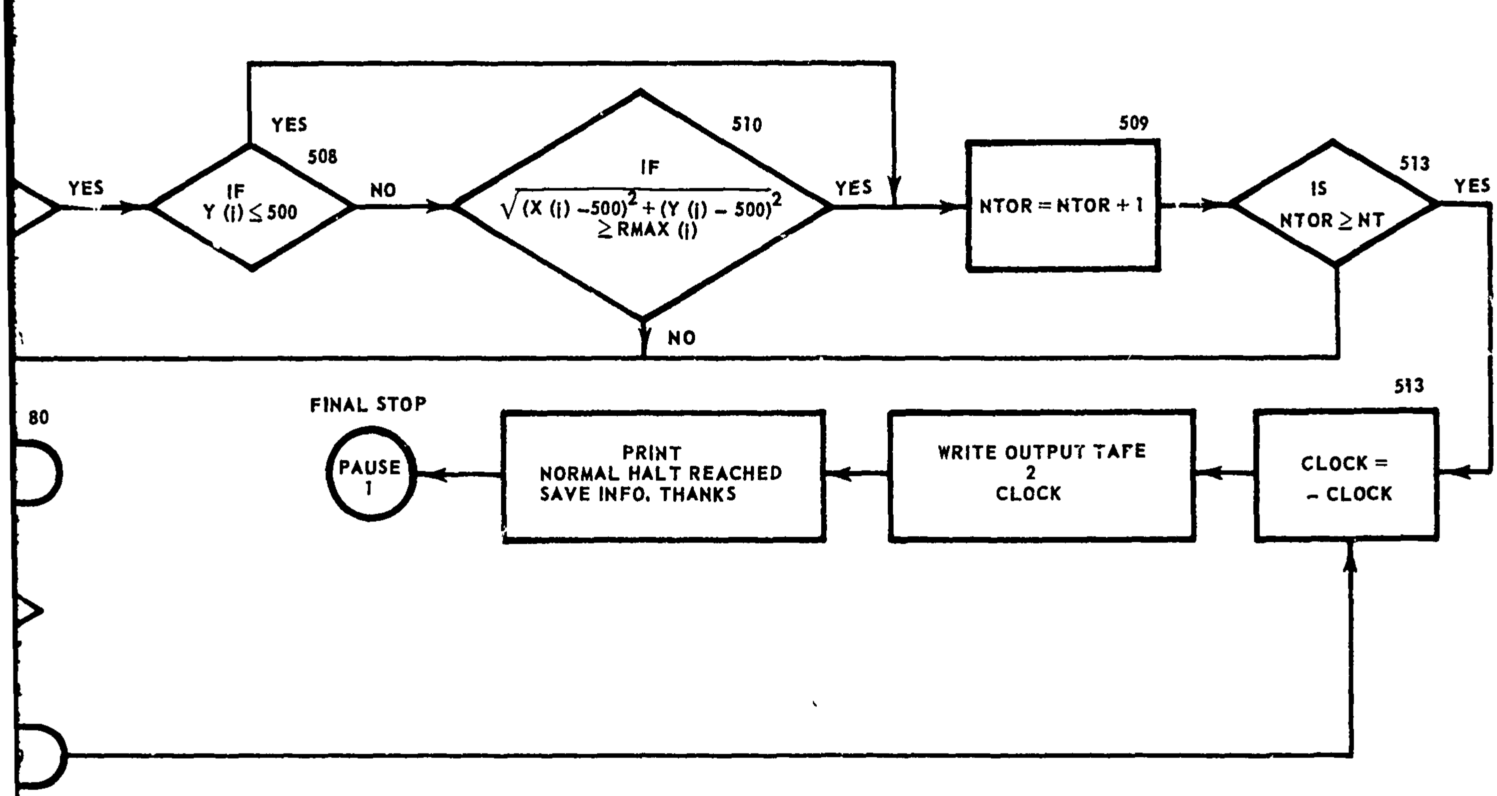


Figure 2-2 (Cont.)

B,

2.3 MODIFICATION TO ACCEPT NEW ENVIRONMENT GENERATOR

2.3.1 FORTRAN Listing

```
       DIMENSION LJTHX(50),LTOTX(50),LAZDEX(50),NSIGNO(153)
       DIMENSION NTTOAA(100),DISTT(100),NMST(100),NMSA(100),DISMS(100),
      1NHTT(100),NHTA(100),DISHT(100),NFST(100),NFSA(100),DISFS(100)
       DIMENSION DIST(31),DISH(31)
       DIMENSION DIFX(100),DIFY(100)
       DIMENSION X(100),Y(100),RMIN(100),RMIN2(100),RMAX(100),M(100),
      1RO(100),R1(100),R2(100),AZ(100)
       DIMENSION NRESOL(100),LJTH(50),LAZ(50),XAP(100),YAP(100),LAZDEL(50
      1),LTOT(50)
       READ 5050,MONTH,NDAY,NYEAR
5050   FORMAT(3I2)
1500   DO 5333 I=1,50
       LTOTX(I)=0
5333   LAZDEX(I)=0
       SUX=0.
       SUM=0.
       FRE1=0.
       FRE2=0.
       FRED=0.
       FREQ=0.
       FRED2=0.
       FREQ2=0.
       DXH=0.
       DXM=0.
       PRINT 845,MONTH,NDAY,NYEAR
       DO  8050 I =1,31
       DISH(I)=0.
8050   DIST(I)=0.
 5002  FORMAT(90H                                                  TLQ 8 PROGRAM
      XDATA. BENDIX SYSTEMS DIVISION 704.)
       DO 5334 I=1,50
5334   LJTHX(I)=0
       DO 8000 I=1,153
8000   NSIGNO(I)=0
       O=0.
       READ 350,K1,K2,K3,K4,K5,K6,K7,K8,K9,K0
350     FORMAT(10I1)
       READ 3,CASE,AZMUL,DELMUL,AZRES,DELRES,GAIN
3      FORMAT(6F10.1)
       REWIND 2
       READ INPUT TAPE 2,1150,NT,NF,ID
```

FORTRAN LISTING 2

```
1150   FORMAT(3I5)
```

```
      DO 1151 I=1,NT
1151  READ INPUT TAPE 2,1152,RMAX(I),RMIN(I),RMIN2(I)
      CLOCKL=NF
      CLOCKS=0.
      XX=CLOCKS
      PRINT 5002
      PRINT 700,CASE,NT
700    FORMAT(12H CASE NUMBERF8.0,4H  NTI4)
      PRINT 1100,CLOCKL,AZMUL,DELMUL,AZRES,DELRES,GAIN
1100  FORMAT((16H           CLOCKLF5.0,6H AZMULF8.6,7H DELMULF8.6,6H AZRE
     1SF8.7,7H DELRESF8.6,5H GAINF8.6)//)
      PRINT 701
701   FORMAT((118H CLOCK   K NSUMM1 NSUMM2 NSUMM3 NMS NHT NFS NFARAT NHT
     1RAT NMSRAT NDTRAT KOUNT6 KOUNT7 KOUNT8 KOUNT5 KNTSUM  KOUNT9 NDR
     2 )//)
400   FORMAT(5F10.2)
1152  FORMAT(3E16.8)
      CONV=57.29577
      XO=500.
      YO=500.
      X1=456.6985
      X2=475.
      Y1=475.
      Y2=543.3015
      KK=0
      KK1=0
      KK2=0
      KK3=0
      KK4=0
      KK5=0
      KK6=0
      KK7=0
      KK8=0
      AK9=0.
      AK1=0.
599   FORMAT(F6.0)
7     READ INPUT TAPE 2,599,CLOCK
      IF(CLOCK) 301,1177,1177
1177  DO 1153 I=1,NT
1153   READ INPUT TAPE 2, 1154,X(I),Y(I)
1154  FORMAT(2E16.8)
      KOUNT1=0
      KOUNT2=0
      KOUNT3=0
      KOUNT4=0
```

FORTRAN LISTING 3

```
      KOUNT5=0
      KOUNT6=0
      KOUNT7=0
      KOUNT8=0
      KOUNT9=0
      NSUMM1=0
      NSUMM2=0
      NSUMM3=0
      SUMLO=0.
      SUMO =0.
      SUML1=0.
      SUML2=0.
      DO 50 I=1,NT
      DIFX(I)=X(I)-XO
      DIFY(I)=Y(I)-YO
      RO(I)=SQRTF(DIFX(I)**2+DIFY(I)**2)
      IF(RO(I)-RMAX(I)) 9,9,8
9     IF(RO(I)-RMIN(I)) 500,500,501
500   SUMLO=SUMLO+RMIN2(I)
      GO TO 502
501     SUMLO=SUMLO+1./RO(I)**2
502    SUMO=SUMO+1./RO(I)**2
8     R1(I)=SQRTF((X(I)-X1)**2+(Y(I)-Y1)**2)
      IF(R1(I)-RMAX(I)) 11,11,650

11    IF(R1(I)-RMIN(I)) 652,651,651
651   SUML1=SUML1+1./R1(I)**2
      GO TO 650
652    SUML1=SUML1+RMIN2(I)
650   CONTINUE
13    R2(I)=SQRTF((X(I)-X2)**2+(Y(I)-Y2)**2)
      IF(R2(I)-RMAX(I)) 15,15,660
15    IF(R2(I)-RMIN(I)) 662,661,661
661   SUML2=SUML2+1./R2(I)**2
      GO TO 660
662   SUML2=SUML2+RMIN2(I)
660   CONTINUE
      IF(DIFY(I)) 18,18,19
18    M(I)=3
      NSUMM3=NSUMM3+1
      GO TO 50
19    IF(RO(I)-RMAX(I)) 40,40,22
 40   IF(DIFX(I))20,23,23
20    IF(R1(I)-RMAX(I)) 21,21,22
22    M(I)=4
      GO TO 50
21    M(I)=1
```

FORTRAN LISTING 4

```
       NSUMM1=NSUMM1+1
       GO TO 26
23     IF(R2(I)-RMAX(I)) 25,25,22
25     M(I)=2
       NSUMM2=NSUMM2+1
26     AZ(I)=ATN1F(DIFY(I),-DIFX(I))
50     CONTINUE
       DO 56 I=1,50
       LJTH(I)=0
        LAZ(I)=0
       LAZDEL(I)=0
56     LTOT(I)=0
       K=0
       LINDX=0
       DO 100 J=1,NT
       IF(M(J)) 100,58,58
58     IF(XABSF(M(J))-2) 60,60,100
60     L=0
       DO 76 I=1,NT
       IF(XABSF(M(I))-XABSF(M(J))) 76,62,76
  62   IF((ABSF(AZ(J)-AZ(I)))-AZRES) 64,64,76
64     L=L+1
       NRESOL(L)=I
76     CONTINUE
72     SIDLO=SUMO
       AMB=0.
       AMBL=0.
74     IF(XABSF(M(J))-1) 75,71,75
75     RADOMA=SUML2
       GO TO 77
71     RADOMA=SUML1
77     DO 88 I=1,L
       KBAS=NRESOL(I)
       FRACT=1./RO(KBAS)**2
       FLJ=1.-ABSF((AZ(J)-AZ(KBAS))/AZRES)
       AMB=AMB+FLJ*FRACT
       IF(FRACT-RMIN2(KBAS)) 275,275,274
274    FRACT=RMIN2(KBAS)
275    AMBL=AMBL+FLJ*FRACT
       IF(J-KBAS) 88,276,88
276    TARGML=FRACT
       IF(XABSF(M(J))-1) 83,85,83
83     IF(R2(KBAS)-RMIN(KBAS)) 680,680,681
680    RANGMA=RMIN(KBAS)**2
       GO TO 682
681    RANGMA=R2(KBAS)**2
```

FORTRAN LISTING 5

```
  682  CONTINUE
       DELTA=RO(J)-R2(J)
       GO TO 88
 85    IF(R1(KBAS)-RMIN(KBAS)) 690,690,691
 690   RANGMA=RMIN(KBAS)**2
       GO TO 692
 691   RANGMA=R1(KBAS)**2
 692   CONTINUE
       DELTA=RO(J)-R1(J)
 88    CONTINUE
       IF(AMBL-(SUMO-AMB)*GAIN)4000,89,89
 4000   KOUNT9=KOUNT9+1
       GO TO 100
 89    AOSIGO=((SUMO-AMB)*GAIN+AMBL-TARGML)/TARGML
       AOSIGA=(RANGMA*RADOMA)-1.
       SIGNO=1./(2.+AOSIGO+AOSIGA+AOSIGO*AOSIGA)
       NS=SIGNO*500.
       NS=NS+1
       IF(NS-152) 8002,8002,8001
 8001  NSIGNO(152)=NS!GNO(152)+1
       GO TO 8003
 8002  NSIGNO(NS)=NSIGNO(NS)+1
 8003   CONTINUE
       IF(SIGNO-.0112) 99,101,101
 101   KOUNT1=KOUNT1+1
       GO TO 112
 99    IF(SIGNO-.00841) 103,102,102
 102   KOUNT2=KOUNT2+1
       IF(RAM2BF(O)-.6) 112,250,250
 103   IF(SIGNO-.00631) 105,104,104
 104    KOUNT3=KOUNT3+1
       IF(RAM2BF(O)-.2) 112,250,250
 105    KOUNT4=KOUNT4+1
 250   CONTINUE
       GO TO 100
 112   KOUNT5=KOUNT5+1
       IF(L-1) 113,113,114
 114   KOUNT6=KOUNT6+1
       LINDX=LINDX+1
       IF(LINDX-50) 73,73,122
 73    LJTH(LINDX) =J
       LJTHX(L)=LJTHX(L)+1
       LAZ(LINDX) =L
       GO TO 122
 113   A2T=AZ (J)
 115   ANO=(RAM2BF(O)-.5)*AZMUL
```

FORTRAN LISTING 6

```
      A2T=A2T+ANO
      BNO=(RAM2BF(O)-.5)*DELMUL
      DELTA=DELTA+ BNO
      IF(XABSF(M(J))-1) 116,116,117
116   ANGLE=A2T+.5235988
      GO TO 118
117   ANGLE=A2T-1.0471976
118   RANGE=(2500.-DELTA**2)/(100.*COSF(ANGLE)-2.*DELTA)
1298  CONTINUE
      K=K+1
120    XAP(K)=XO-RANGE*COSF(A2T)
121   YAP(K)=YO+RANGE*SINF(A2T)
      GO TO 100
122   NEEL=0
      DO 130 I=1,L
      KBAS=NRESOL(I)
      IF(XABSF(M(J))-1)  123,123,124
124   IF(ABSF(RO(KBAS)-R2(KBAS)-DELTA)-DELRES) 127,127,130
123   IF(ABSF(RO(KBAS)-R1(KBAS)-DELTA)-DELRES) 127,127,130
127   NEEL=NEEL+1
      M(KBAS)=-M(KBAS)
      NRESOL(NEEL)=NRESOL(I)
130   CONTINUE
      LAZDEX(NEEL)=LAZDEX(NEEL)+1
      IF(NEEL-1) 517,517,132
517   KOUNT8=KOUNT8+1
      IF(LINDX-50)7000,7000,113
7000  LAZDEL(LINDX)=1
      LTOT(LINDX)=1
      GO TO 113
 132  KLOO=1
      IF(LINDX-50)133,133,134
133   LAZDEL(LINDX)=NEEL
134   IF(NRESOL(KLOO)-J) 135,150,135
135   IND=NRESOL(KLOO)
      IF(XABSF(M(J))-1) 136,136,137
136   ADELTA=RO(IND)-R1(IND)
      GO TO 140
137   ADELTA=RO(IND)-R2(IND)
140   DO 149 I=1,NT
      IF(M(I)) 149,777,777
777   IF(XABSF(M(I))-XABSF(M(J)))149,141,149
141    IF(ABSF(AZ(I)-AZ(KLOO))-AZRES) 142,142,149
142   IF(XABSF(M(J))-1) 146,146,143
146   IF(ABSF(RO(I)-R1(I)-ADELTA)-DELRES) 144,144,149
144    NEEL=NEEL+1
```

FORTRAN LISTING 7

```
      NRESOL(NEEL)=I
      M(I)=-M(I)
      GO TO 149
```

```
  143   IF(ABSF(RO(I)-R2(I)-ADELTA)-DELRES) 144,144,149
  149   CONTINUE
  150   KLOO=KLOO+1
        IF(KLOO-NEEL) 134,134,152
  152   LTOTX(NEEL)=LTOTX(NEEL)+1
        IF(LINDX-50)155,155,156
  155   LTOT(LINDX)=NEEL
  156   SUMAZ=0.
        DENOM=NEEL
        KOUNT7=KOUNT7+NEEL
        A2T=0.
        DO 160 I=1,NEEL
        KBAS=NRESOL(I)
        IF(AZ(KBAS)-A2T) 160,160,277
  277   A2T=AZ(KBAS)
        IF(XABSF(M(J))-1)278,278,279
  278   DELTA=RO(KBAS)-R1(KBAS)
        GO TO 160
  279   DELTA=RO(KBAS)-R2(KBAS)
  160   CONTINUE
        GO TO 115
  100   CONTINUE
        NMS=0
        NHT=0
        NFS=0
        IF(K)570,571,570
  571    DO 572 ITR=1,NT
        NMS=NMS+1
        NMST(NMS)=ITR
         NMSA(NMS)=-0
  572   DISMS(NMS)=-0
        GO TO 575
  570    DO 168 ITR=1,NT
        IAP=1
         NTTOAA(ITR) =1
        XTRU=X(ITR)
        YTRU=Y(ITR)
        DIFRX=ABSF(XTRU-XAP(IAP))
        DIFRY=ABSF(YTRU-YAP(IAP))
        DISSQ=DIFRY**2+DIFRX**2
        DO 166 IAP=2,K
        TDIFRX=ABSF(XTRU-XAP(IAP))
        TDIFRY=ABSF(YTRU-YAP(IAP))
            FORTRAN LISTING 8

         IF(TDIFRX-DIFRX) 165,164,164
  164   IF(TDIFRY-DIFRY)165,166,166
  165    TDISSQ=TDIFRX**2+TDIFRY**2
        IF(TDISSQ-DISSQ) 167,166,166
```

```
167   N:TOAA(ITR)=IA
      DISSQ=TDISSQ
      DIFRX:TDIFRX
      DIFRY=TDIFRY
166   CONTINUE
168   DISTT(ITR)=SQRTF(DISSQ)
171   DO 178 IAP=1,K
      ITR=1
      NATOTT=1
      YAPP=YAP(IAP)
      XAPP=XAP(IAP)
      DIFRX=ABSF(X(ITR)-XAPP)
      DIFRY=ABSF(Y(ITR)-YAPP)
      DISSQ=DIFRX**2+DIFRY**2
172    DO 175 ITR=2,NT
      TDIFRX=ABSF(X(ITR)-XAPP)
      TDIFRY=ABSF(Y(ITR)-YAPP)
      IF(TDIFRX-DIFRX) 169,170,170
170     IF(TDIFRY-DIFRY) 169,175,175
169   TDISSQ=TDIFRX**2+TDIFRY**2
      IF(TDISSQ-DISSQ) 173,175,175
173   NATOTT=ITR
      DISSQ=TDISSQ
      DIFRX=TDIFRX
      DIFRY=TDIFRY
175    CONTINUE
        DISTA=SQRTF(DISSQ)
      IF(XABSF(NTTOAA(NATOTT))-IAP) 176,177,176
177   NHT=NHT+1
      NHTT(NHT)=NATOTT
      NHTA(NHT)=IAP
      DISHT(NHT)=DISTT(NATOTT)
      MHD=DISHT(NHT)*4.
      MHD=MHD+1
      IF(MHD-31) 1404,1405,1405
1405  DISH(31)=DISH(31)+1.
      GO TO 1406
1404  DISH(MHD)=DISH(MHD)+1.
1406  CC:TINUE
      NTTOAA(NATOTT)=-NTTOAA(NATOTT)
      GO TO 178
176    NFS=NFS+1
```

FORTRAN LISTING 9

```
      NFST(NFS)=NATOTT
      NFSA(NFS)=IAP
      DISFS(NFS)=SQRTF(DISSQ)
178    CONTINUE
      DO 440 ITR=1,NT
      IF(NTTOAA(ITR)) 440,440,442
```

```
442    NMS=NMS+1
       NMST(NMS)=ITR
        NMSA(NMS)=NTTOAA(ITR)
       DISMS(NMS)=DISTT(ITR)
       MDS=DISMS(NMS)/5.
       MDS=MDS+1
       IF(MDS-31) 1400,1401,1401
1401   DIST(31)=DIST(31)+1.
       GO TO 1402
1400   DIST(MDS)=DIST(MDS)+1.
1402   CONTINUE
440    CONTINUE
575    CONTINUE
       NFARAT=(1000*NFS)/K
       NMSRAT=(1000*NMS)/NT
       NDTRAT=(1000*K)/NT
       NHTRAT=(1000*NHT)/K
       KNTSUM=(10*KOUNT1+6*KOUNT2+2*KOUNT3)
       NDR=(1000*K)/(NSUMM1+NSUMM2)
       ANDR=NDR
       ANDR=ANDR/1000.
       AND2=ANDR**2
       AK1=AK1+AND2
       XX=XX+1.
       IF(XX-(51.+CLOCKS))844,843,844
843    PRINT 845,MONTH,NDAY,NYEAR
       XX=CLOCKS
       PRINT 5002
       PRINT 700,CASE,NT
845    FORMAT(108H1
      1                                                   DATE RUNI3,1H/I2,1H/I
      22)
       PRINT 701
844    CONTINUE
       PRINT 702,CLOCK,K,NSUMM1,NSUMM2,NSUMM3,NMS,NHT,NFS,NFARAT,NHTRAT,
      1NMSRAT,NDTRAT,KOUNT6,KOUNT7,KOUNT8,KOUNT5,KNTSUM,KOUNT9,NDR
       KK=KK+K
       KK2=KK2+NSUMM1
       KK3=KK3+NSUMM2
       KK4=KK4+NMS
```

FORTRAN LISTING 10

```
       KK5=KK5+NHT
       KK6=KK6+NFS
       KK7=KK7+KOUNT6
       KK8=KK8+KOUNT8
       AK9=AK9+ANDR
702    FORMAT(F6.0,I4,I4,3I7,2I4,I5,3I7,I6,3I7,2I8,I5)
```

```
      IF(K3) 8075,8075,8076
8076  CONTINUE
      WRITE OUTPUT TAPE 4,900,CASE,CLOCK,NT,K
900   FORMAT(F11.6,F10.0,2I5)
      DO 901 I=1,NT
901    WRITE OUTPUT TAPE 4,902,X(I),Y(I)
902   FORMAT(2F15.4)
      IF(K) 6000,6001,6000
6000  DO 903 I=1,K
903   WRITE OUTPUT TAPE 4,902,XAP(I),YAP(I)
6001  CONTINUE
8075  CONTINUE
359   IF(K6) 361,361,362
362   KEN=6
      IF(NMS) 2100,2200,2100
2100  DO 906 I=1,NMS
906    WRITE OUTPUT TAPE 3,907,KEN,CASE,CLOCK,NMST(I),NMSA(I),DISMS(I)
2200  CONTINUE
361   IF(K7) 363,363,364
364   KEN=7
      IF(NHT) 2101,2102,2101
2101  DO 908 I=1,NHT
      IS=NHTA(I)
      ID=NHTT(I)
908   WRITE OUTPUT TAPE 3,907,KEN,CASE,CLOCK,NHTT(I),NHTA(I),DISHT(I),
     1X(ID),Y(ID),XAP(IS),YAP(IS)
2102  CONTINUE
363    IF(K8) 365,365,366
366   KEN=8
      IF(NFS) 2103,2104,2103
2103  DO 909 I=1,NFS
909   WRITE OUTPUT TAPE 3,907,KEN,CASE,CLOCK,NFST(I),NFSA(I),DISFS(I)
365    CONTINUE
2104  CONTINUE
      GO TO 7
301   KEN=0
5555  FORMAT(4H TOTI6,I5,I6,I13,2I5,I31,I14,F28.3)
      PRINT 5555,KK,KK2,KK3,KK4,KK5,KK6,KK7,KK8,AK9
      PRINT 6500,AK1
6500  FORMAT(F120.6)
          FORTRAN LISTING 11

5557   FORMAT(7H  TOTALI14,I9,I15)
      PRINT 845,MONTH,NDAY,NYEAR
      PRINT 700,CASE,NT
      PRINT 5002
      PRINT 1666
1666  FORMAT(56H                HITS                                  MISSES
     1)
```

```
      PRINT 1667
 1667 FORMAT(70H     LOWER  UPPER  NUMBER  STD FREQ     LOWER UPPER  NUM
     1BER  STD FREQ  )
 1408 FORMAT(37H      HITS                      MISSES  )
 1409 FORMAT(46H LOWER  UPPER NUMBER       LOWER  UPPER NUMBER  )
      XLOW=0.
      HIGH=5.
      XLO=0.
      HIG=.25
      DO 1668 I=1,31
      SUX=SUX+DIST(I)
 1668 SUM=SUM+DISH(I)
      SUX=1000./SUX
      SUM=1000./SUM
      DO 1411 I=1,31
      LXX=DISH(I)*SUM+.5
      LYY=DIST(I)*SUX+.5
      PRINT 1410,XLO,HIG,DISH(I),LXX,XLOW,HIGH,DIST(I),LYY
      FREQ=(HIG-XLO)/2.+XLO
      FRED=(HIGH-XLOW)/2.+XLOW
      FREQ2=FREQ2+FREQ**2*DISH(I)
      FRED2=FRED2+FRED**2*DIST(I)
      FRE1=FRE1+FREQ*DISH(I)
      FRE2=FRE2+FRED*DIST(I)
      DXH=DXH+DISH(I)
      DXM=DXM+DIST(I)
      XLOW=HIGH
      HIGH=HIGH+5.
      XLO=HIG
 1411 HIG=HIG+.25
 1410 FORMAT(F10.2,F7.2,F8.0,I10,F10.0,F7.0,F8.0,I10)
      SIGMAH=SQRTF(FREQ2/DXH-(FRE1/DXH)**2)
      SIGMAM=SQRTF(FRED2/DXM-(FRE2/DXM)**2)
      BARH=FRE1/DXH
      BARM=FRE2/DXM
      PRINT 1669,SIGMAH,SIGMAM,BARH,BARM
 1669 FORMAT(13H    SIGMA HITF8.3,11H SIGMA MISSF8.3,9H MEAN HITF9.3,10H
     1 MEAN MISSF9.3)
      IF(KO) 369,369,370
```

FORTRAN LISTING 12

```
 370  HIGH=.002
      PRINT 845,MONTH,NDAY,NYEAR
 5000 FORMAT (1H1)
      PRINT 5002
      PRINT 700,CASE,NT
      PRINT 450
 450  FORMAT(48H          FREQUENCY DISTRIBUTION SIGNAL TO NOISE  )
```

```
      PRINT 451
451   FORMAT(42H      LIMITS                            LIMITS  )
      PRINT 452
452   FORMAT(86H LOWER    UPPER    NUMBER       LOWER    UPPER    NUMBER
     1     LOWER    UPPER    NUMBER  )
      XLOW=.0
      XLOWR=.102
      XLO=.204
      XHIG=.206
       HIGHR=.104
      DO 453 I=1,51
      PRINT 454,XLOW,HIGH,NSIGNO(I),XLOWR,HIGHR,NSIGNO(I+51),XLO,XHIG,
     1NSIGNO(I+101)
454   FORMAT(F6.3,F9.3,I8,F13.3,F9.3,I8,F13.3,F9.3,I8)
      XLO=XHIG
       XHIG=XHIG+.002
888   FORMAT(F6.1,F9.3,I8,F13.3,F9.3,I8)
      XLOW=HIGH
       HIGH=HIGH+.002
      XLOWR=HIGHR
453   HIGHR=HIGHR+.002
369   CONTINUE
  465 FORMAT(17H DURING THIS RAID14,53H AZIMUTH UNRESOLVE SECTORS WERE F
     XOUND WHICH CONTAINEDI5,8H TARGETS)
      IF(K1) 460,460,461
461   PRINT 845,MONTH,NDAY,NYEAR
      PRINT 700,CASE,NT
      PRINT 472
      LL1=0
      LL2=0
      LL3=0
       DO 464 I=2,50
      LL1=LL1+LJTHX(I)
      LL2=LL2+LAZDEX(I)
5556  LL3=LL3+LTOTX(I)
464   PRINT 462,I,LJTHX(I),LAZDEX(I),LTOTX(I),I
      PRINT 5557,LL1,LL2,LL3
472   FORMAT(57H  NO TARGETS   AZ UNR   AZ+DEL  AZ+DEL+OTHERS  NO TARGET
     1S )
```

FORTRAN LISTING 13

```
462   FORMAT(I12,2I9,I15,I9)
460   CONTINUE
      PAUSE 1
      GO TO 1500
907   FORMAT(I5,F10.5,F5.0,2I8,5F8.2)
 904  FORMAT(I5,F10.5,F5.0,5I8)
      END(0,1,1,0,1)
```

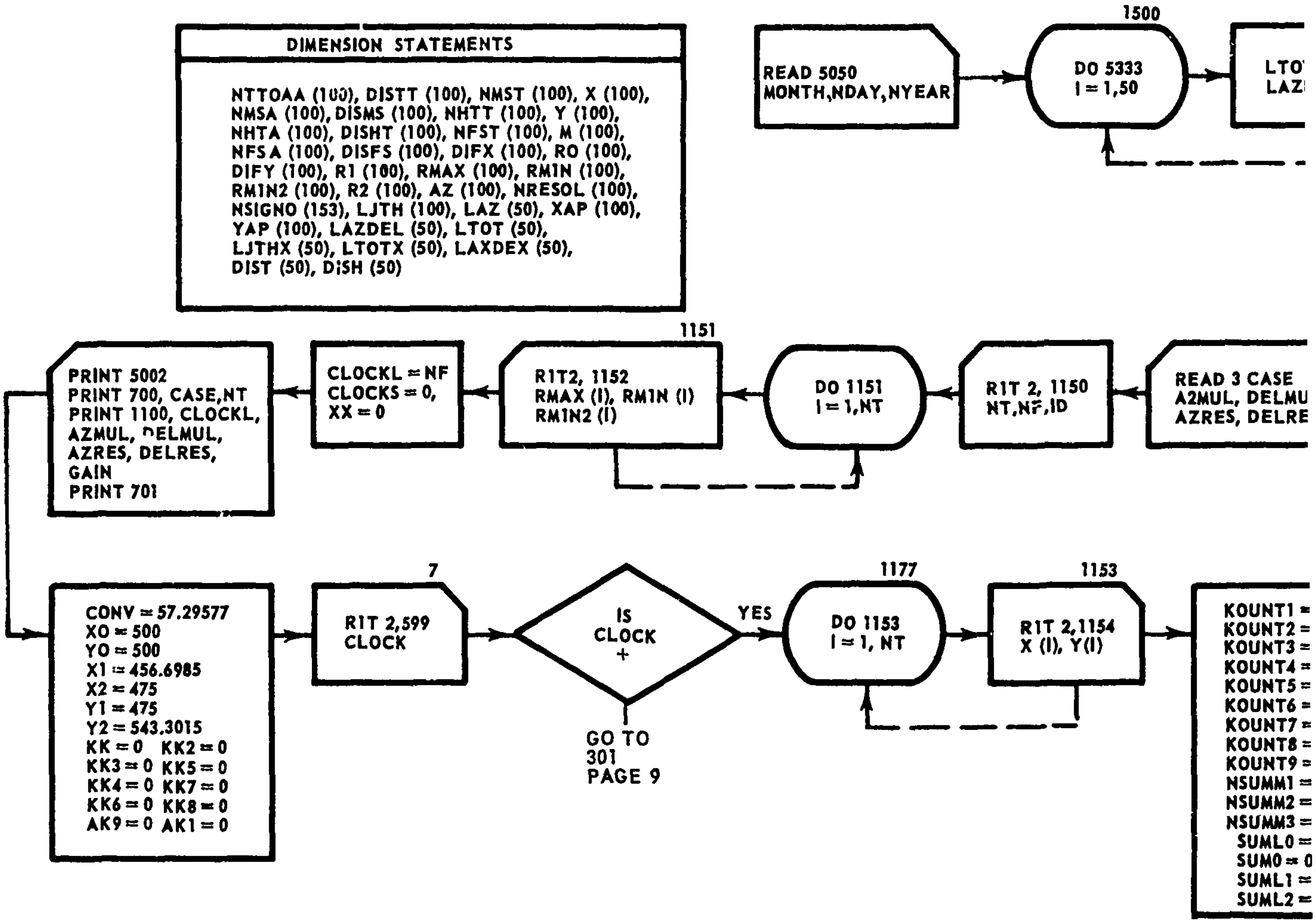


Figure 2-3 Acc
P

A

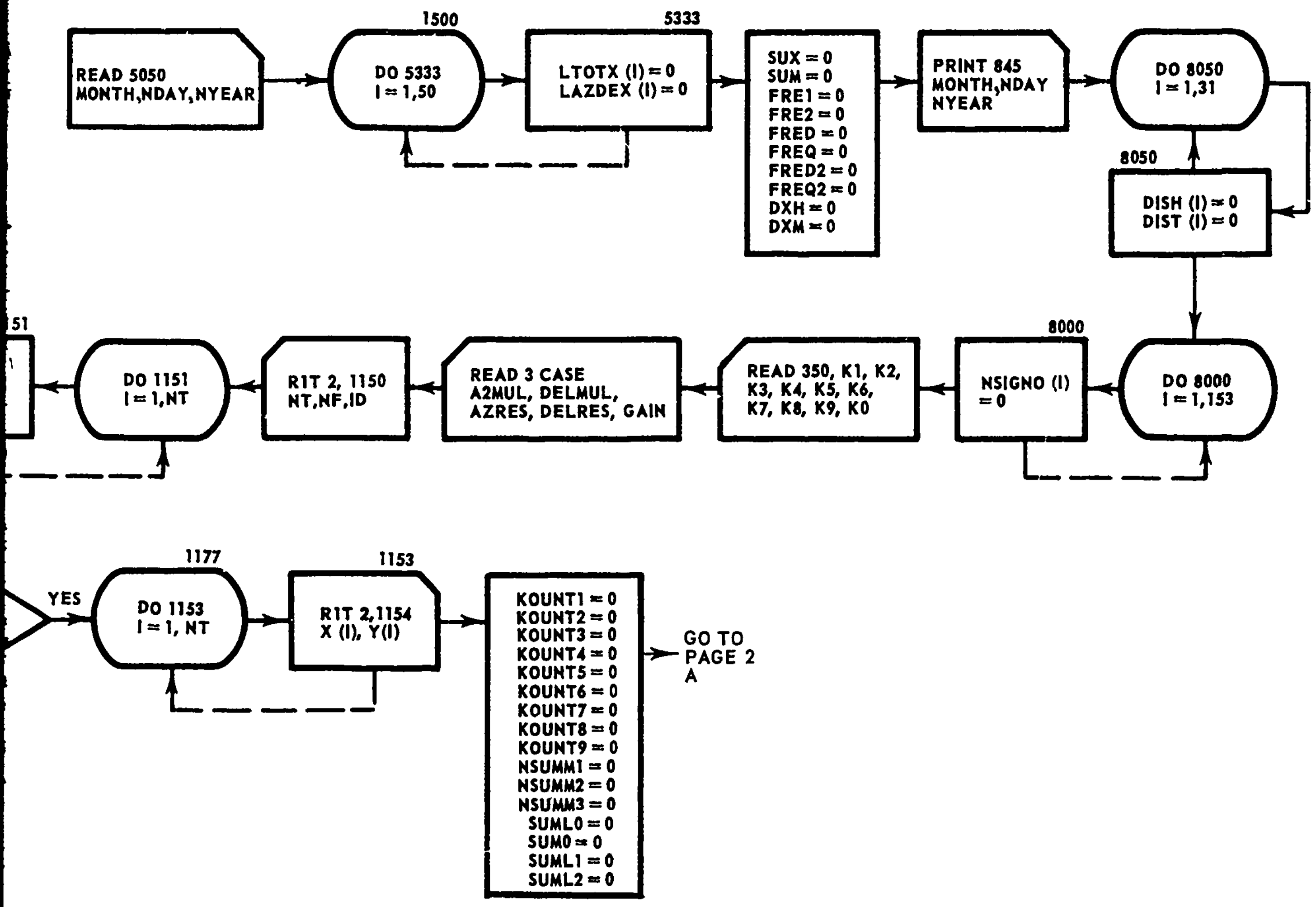
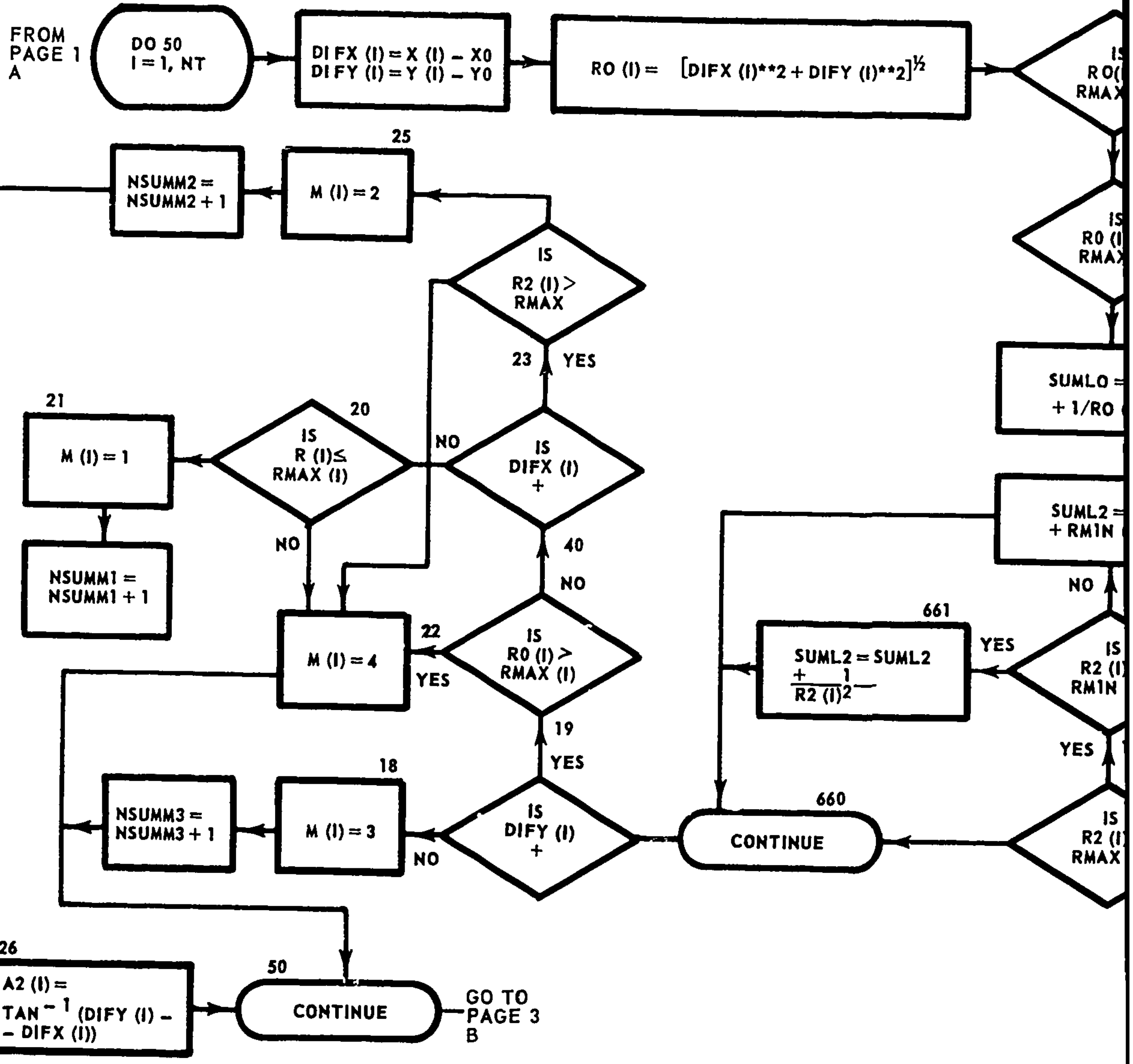


Figure 2-3 Accept New Environment Generator
Program Flow Diagram

B.


FROM PAGE 1 A
DO 50 I = 1, NT
DIFX (I) = X (I) – X0
DIFY (I) = Y (I) – Y0
RO (I) = [DIFX (I)**2 + DIFY (I)**2]½
IS RO(I RMAX
IS RO (I RMAX
SUMLO = + 1/RO
SUML2 = + RMIN
NO
661
SUML2 = SUML2 + 1/R2 (I)2
YES
IS R2 (I RMIN
YES
IS R2 (I RMAX
660
CONTINUE
25
M (I) = 2
NSUMM2 = NSUMM2 + 1
IS R2 (I) > RMAX
23
YES
21
M (I) = 1
NSUMM1 = NSUMM1 + 1
20
IS R (I) ≤ RMAX (I)
NO
NO
IS DIFX (I) +
40
NO
22
M (I) = 4
YES
IS RO (I) > RMAX (I)
19
YES
18
M (I) = 3
NSUMM3 = NSUMM3 + 1
NO
IS DIFY (I) +
26
A2 (I) = TAN⁻¹ (DIFY (I) – – DIFX (I))
50
CONTINUE
GO TO PAGE 3 B

A.

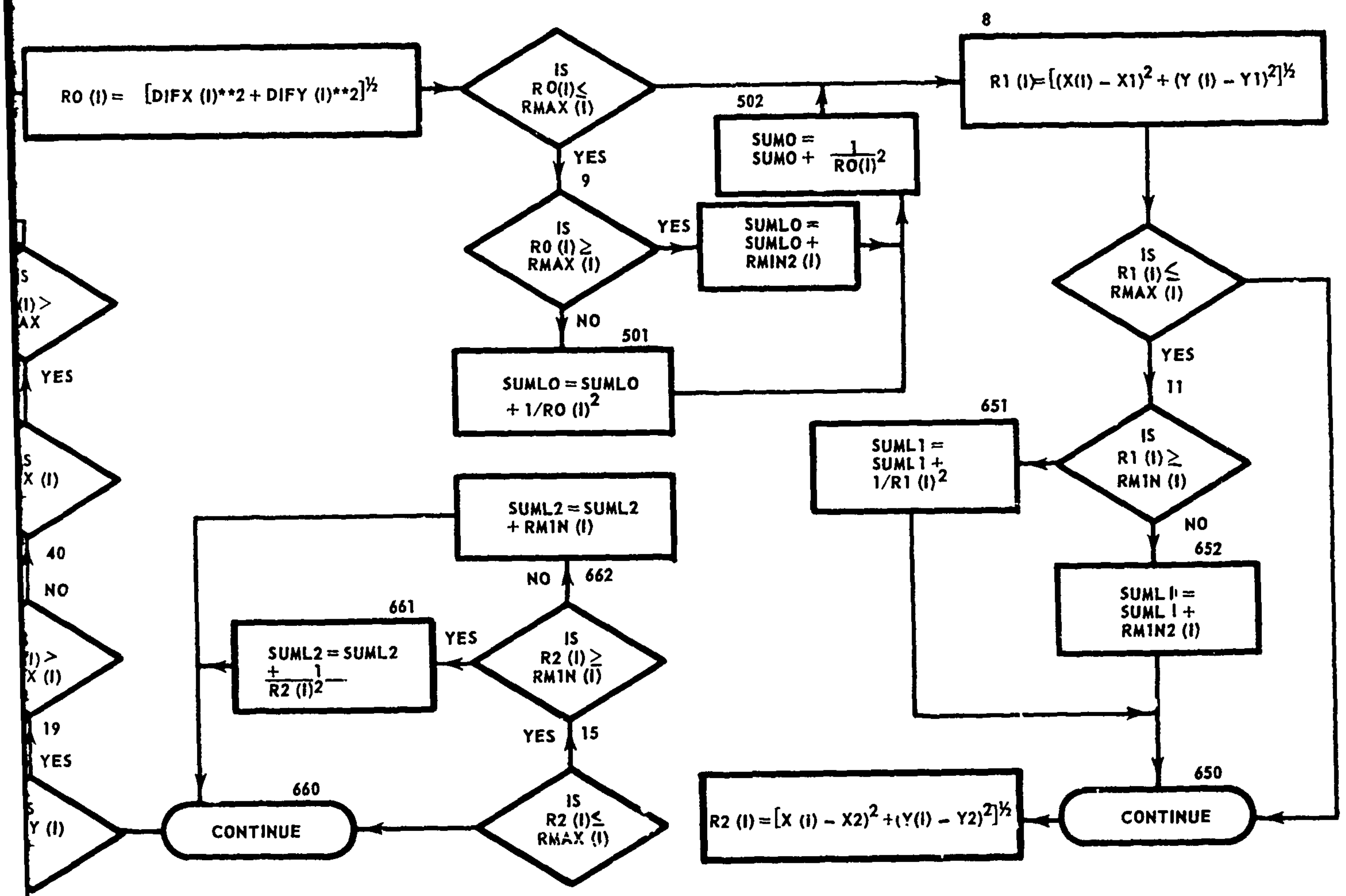
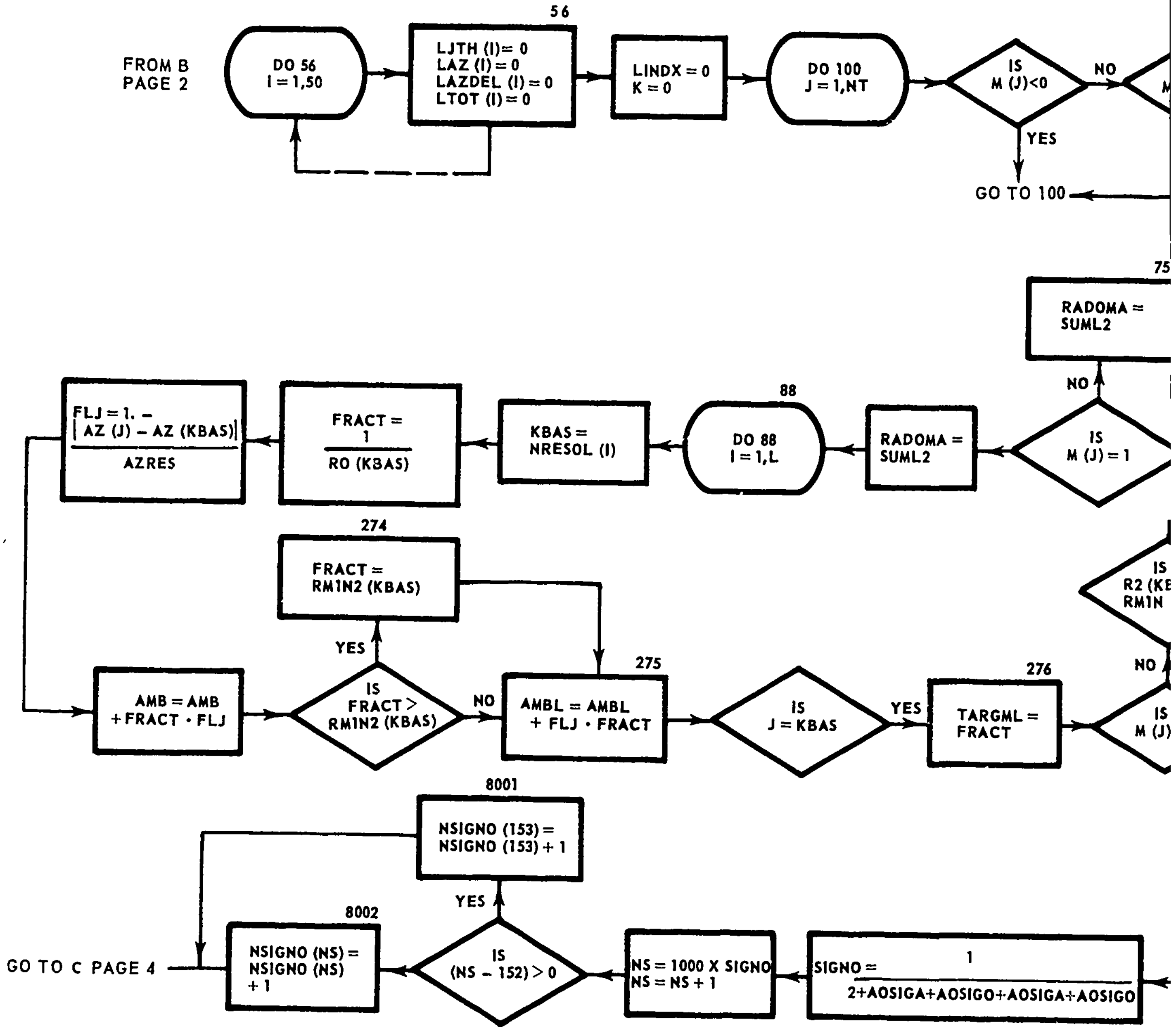

RO (I) = [DIFX (I)**2 + DIFY (I)**2]½
IS R O(I) ≤ RMAX (I)
YES
9
IS RO (I) ≥ RMAX (I)
YES
SUMLO = SUMLO + RMIN2 (I)
NO
501
SUMLO = SUMLO + 1/RO (I)^2
502
SUMO = SUMO + 1/RO(I)^2
8
R1 (I) = [(X(I) – X1)^2 + (Y (I) – Y1)^2]½
IS R1 (I) ≤ RMAX (I)
YES
11
IS R1 (I) ≥ RMIN (I)
651
SUML1 = SUML1 + 1/R1 (I)^2
NO
652
SUML1 = SUML1 + RMIN2 (I)
650
CONTINUE
R2 (I) = [X (I) – X2)^2 + (Y(I) – Y2)^2]½
IS R2 (I) ≤ RMAX (I)
YES
15
IS R2 (I) ≥ RMIN (I)
NO
662
SUML2 = SUML2 + RMIN (I)
YES
661
SUML2 = SUML2 + 1/R2 (I)^2
660
CONTINUE
S (I) > AX
YES
S X (I)
40
NO
I) > X (I)
19
YES
S Y (I)

Figure 2-3 (Cont.)

B


FROM B PAGE 2
DO 56 I = 1,50
56
LJTH (I) = 0
LAZ (I) = 0
LAZDEL (I) = 0
LTOT (I) = 0
LINDX = 0
K = 0
DO 100 J = 1,NT
IS M (J)<0
NO
YES
GO TO 100
75
RADOMA = SUML2
NO
IS M (J) = 1
RADOMA = SUML2
88
DO 88 I = 1,L
KBAS = NRESOL (I)
FRACT = 1 / RO (KBAS)
FLJ = 1. - |AZ (J) - AZ (KBAS)| / AZRES
274
FRACT = RMIN2 (KBAS)
YES
IS FRACT > RMIN2 (KBAS)
NO
AMB = AMB + FRACT · FLJ
275
AMBL = AMBL + FLJ · FRACT
IS J = KBAS
YES
276
TARGML = FRACT
IS R2 (KB RMIN
NO
IS M (J)
8001
NSIGNO (153) = NSIGNO (153) + 1
YES
8002
NSIGNO (NS) = NSIGNO (NS) + 1
IS (NS - 152) > 0
NS = 1000 X SIGNO
NS = NS + 1
SIGNO = 1 / 2+AOSIGA+AOSIGO+AOSIGA+AOSIGO
GO TO C PAGE 4

A

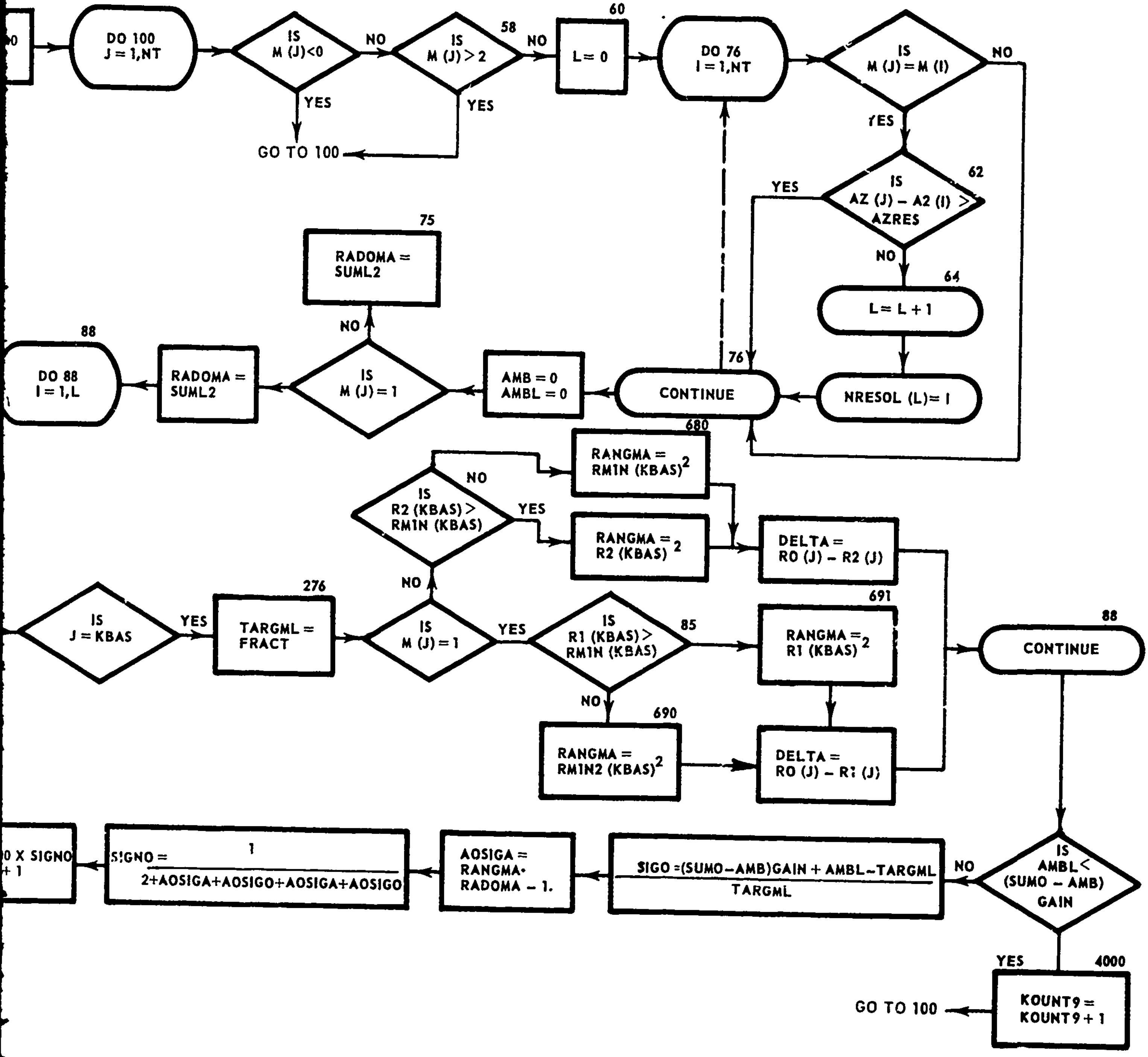
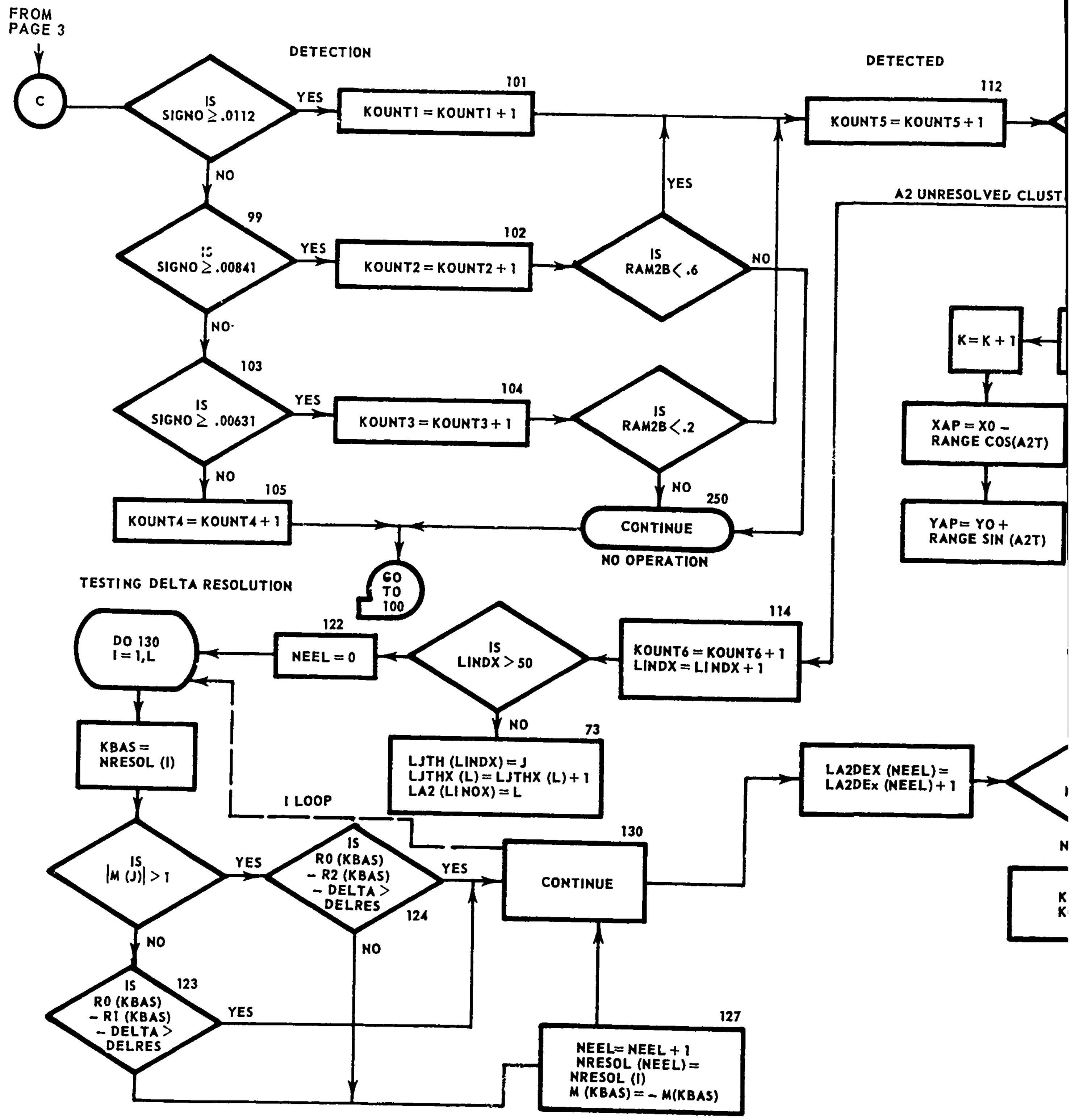


Figure 2-3 (Cont.)


FROM PAGE 3
C
DETECTION
IS SIGNO ≥ .0112
YES
NO
101
KOUNT1 = KOUNT1 + 1
DETECTED
112
KOUNT5 = KOUNT5 + 1
YES
A2 UNRESOLVED CLUST
99
IS SIGNO ≥ .00841
YES
102
KOUNT2 = KOUNT2 + 1
IS RAM2B < .6
NO
NO
K = K + 1
103
IS SIGNO ≥ .00631
YES
104
KOUNT3 = KOUNT3 + 1
IS RAM2B < .2
XAP = X0 – RANGE COS(A2T)
NO
NO
105
KOUNT4 = KOUNT4 + 1
250
CONTINUE
NO OPERATION
YAP = Y0 + RANGE SIN (A2T)
TESTING DELTA RESOLUTION
GO TO 100
114
122
DO 130 I = 1,L
NEEL = 0
IS LINDX > 50
KOUNT6 = KOUNT6 + 1
LINDX = LINDX + 1
NO
73
KBAS = NRESOL (I)
LJTH (LINDX) = J
LJTHX (L) = LJTHX (L) + 1
LA2 (LINOX) = L
LA2DEX (NEEL) = LA2DEx (NEEL) + 1
I LOOP
130
IS |M (J)| > 1
YES
IS R0 (KBAS) – R2 (KBAS) – DELTA > DELRES
YES
124
CONTINUE
N
K
K
NO
NO
IS R0 (KBAS) – R1 (KBAS) – DELTA > DELRES
123
YES
127
NEEL = NEEL + 1
NRESOL (NEEL) = NRESOL (I)
M (KBAS) = – M(KBAS)

A1

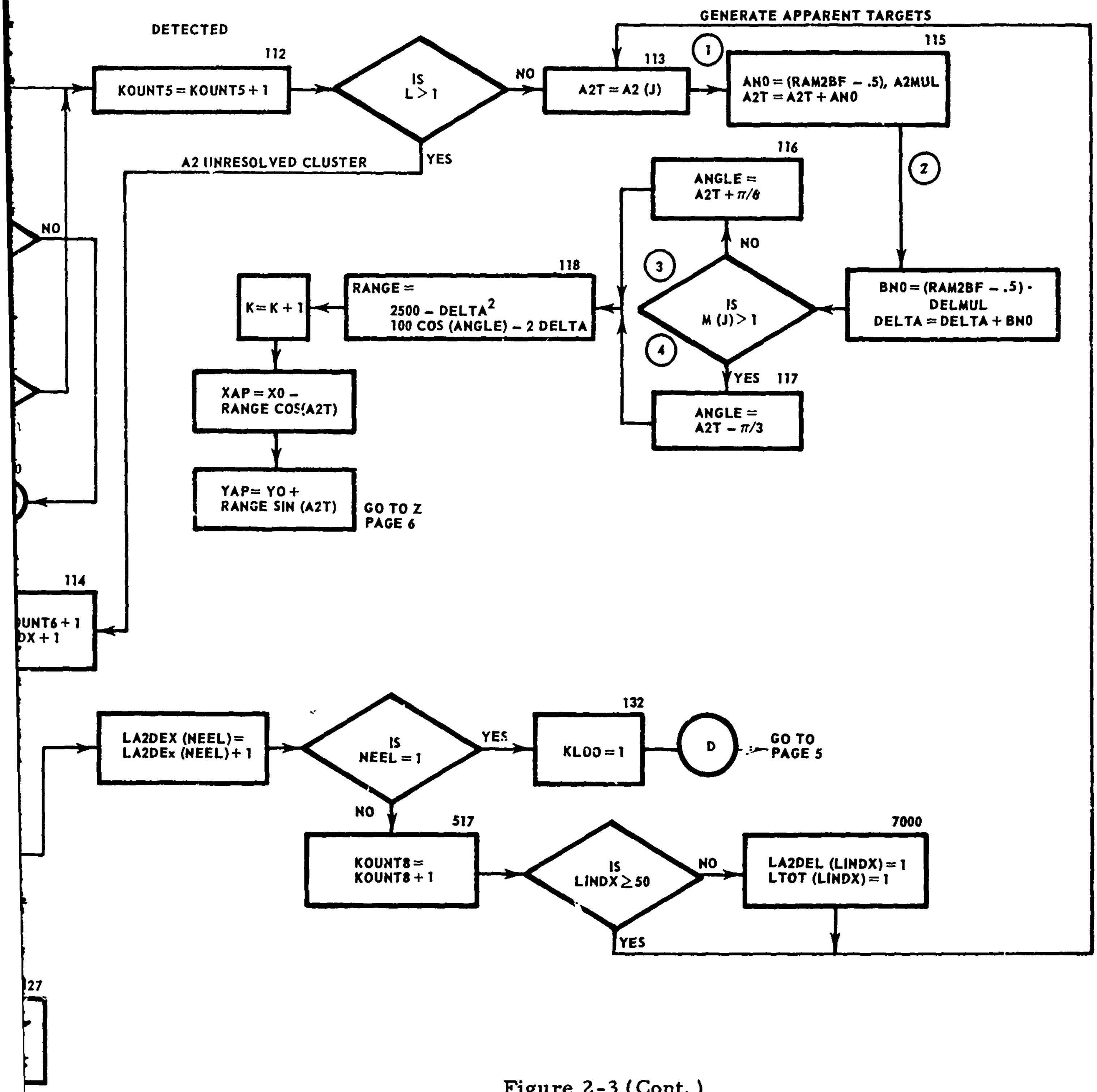
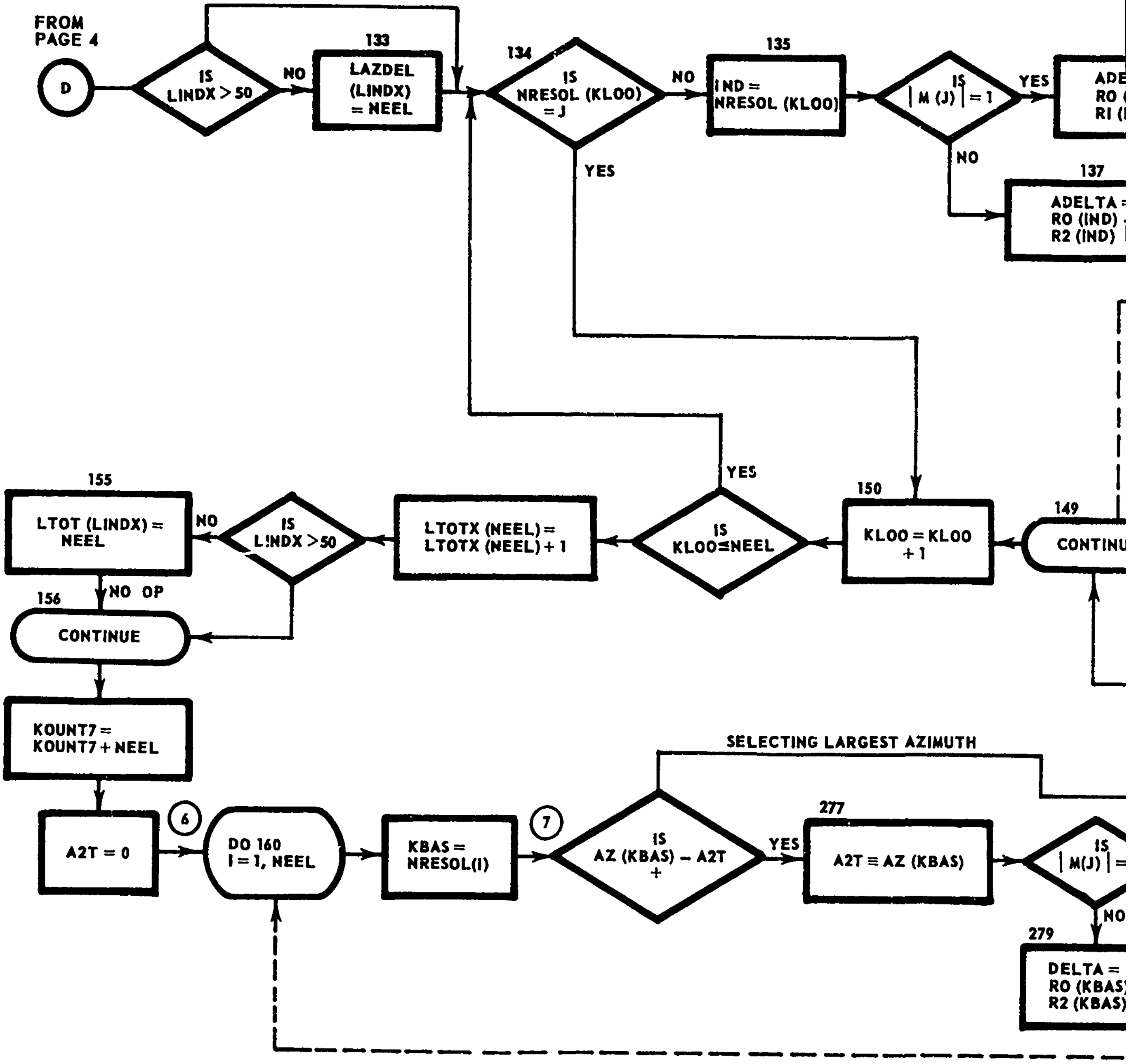


Figure 2-3 (Cont.)

B.


FROM PAGE 4
D
IS LINDX > 50
NO
133
LAZDEL (LINDX) = NEEL
134
IS NRESOL (KLOO) = J
NO
YES
135
IND = NRESOL (KLOO)
IS | M (J) | = 1
YES
ADE
RO
RI
NO
137
ADELTA =
RO (IND)
R2 (IND)
YES
155
LTOT (LINDX) = NEEL
NO
IS LINDX > 50
LTOTX (NEEL) = LTOTX (NEEL) + 1
IS KLOO≡NEEL
150
KLOO = KLOO + 1
149
CONTINU
156
NO OP
CONTINUE
KOUNT7 = KOUNT7 + NEEL
SELECTING LARGEST AZIMUTH
A2T = 0
6
DO 160 I = 1, NEEL
KBAS = NRESOL(I)
7
IS AZ (KBAS) – A2T +
YES
277
A2T ≡ AZ (KBAS)
IS | M(J) | =
NO
279
DELTA =
RO (KBAS
R2 (KBAS)

Figure

A1

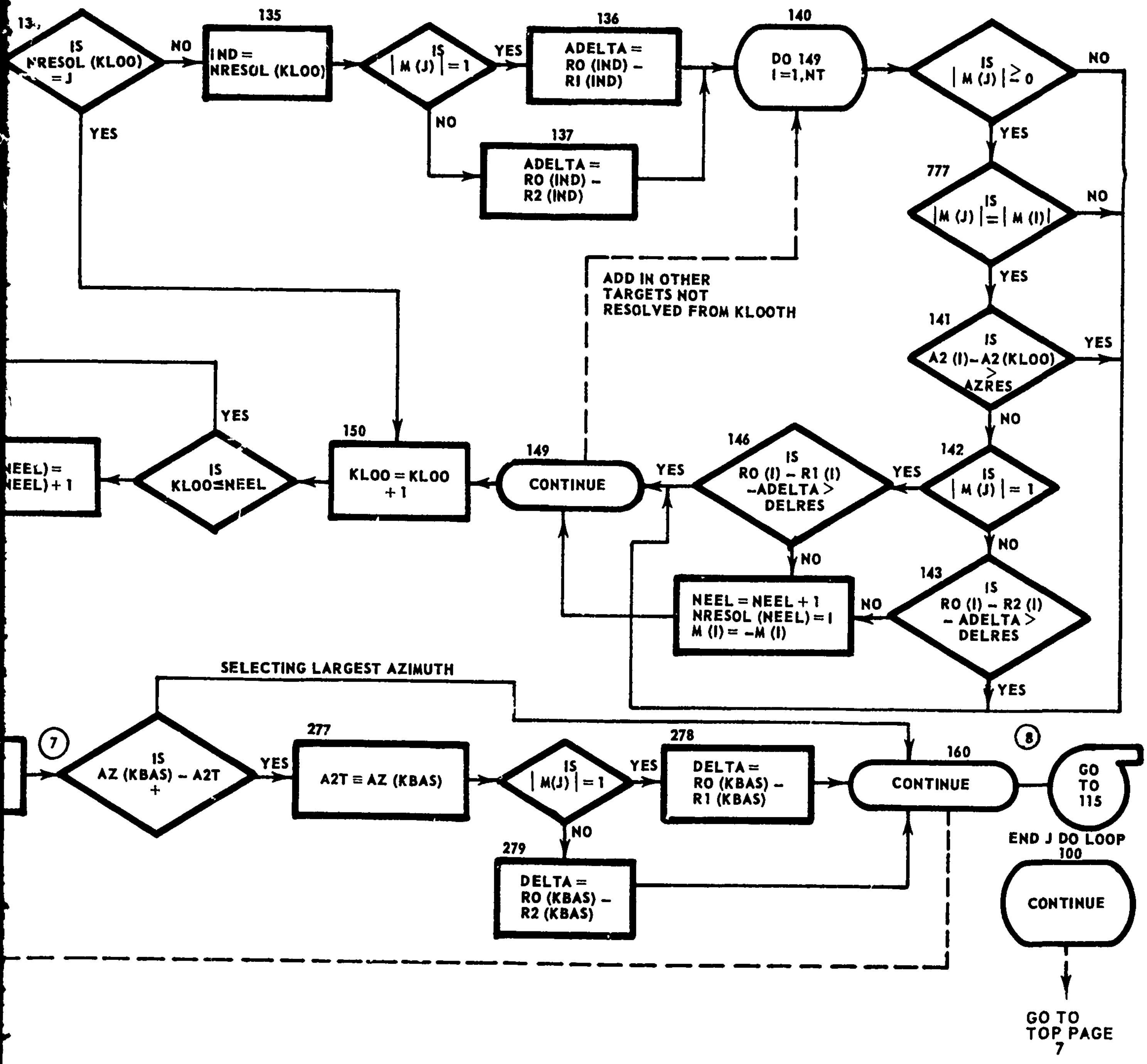
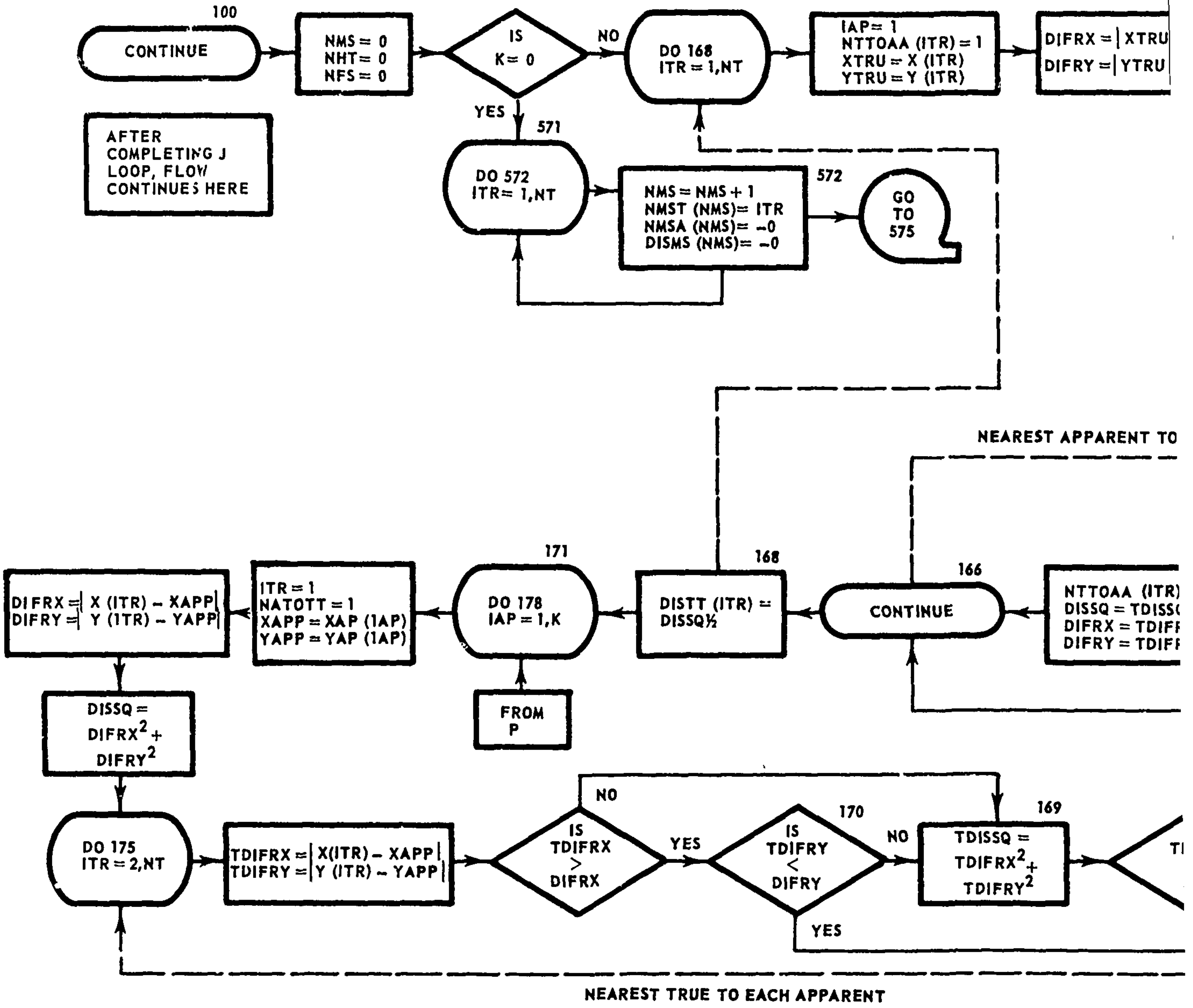


Figure 2-3 (Cont.)

B,


100
CONTINUE
NMS = 0
NHT = 0
NFS = 0
IS
K = 0
NO
YES
DO 168
ITR = 1,NT
IAP = 1
NTTOAA (ITR) = 1
XTRU = X (ITR)
YTRU = Y (ITR)
DIFRX = |XTRU
DIFRY = |YTRU
AFTER
COMPLETING J
LOOP, FLOW
CONTINUES HERE
571
DO 572
ITR = 1,NT
572
NMS = NMS + 1
NMST (NMS) = ITR
NMSA (NMS) = -0
DISMS (NMS) = -0
GO
TO
575
NEAREST APPARENT TO
171
168
166
DIFRX = | X (ITR) - XAPP|
DIFRY = | Y (ITR) - YAPP|
ITR = 1
NATOTT = 1
XAPP = XAP (IAP)
YAPP = YAP (IAP)
DO 178
IAP = 1,K
DISTT (ITR) =
DISSQ½
CONTINUE
NTTOAA (ITR)
DISSQ = TDISS
DIFRX = TDIFF
DIFRY = TDIFF
FROM
P
DISSQ =
DIFRX² +
DIFRY²
NO
170
169
DO 175
ITR = 2,NT
TDIFRX = | X(ITR) - XAPP |
TDIFRY = | Y (ITR) - YAPP |
IS
TDIFRX
>
DIFRX
YES
IS
TDIFRY
<
DIFRY
NO
TDISSQ =
TDIFRX² +
TDIFRY²
TI
YES
NEAREST TRUE TO EACH APPARENT

Fig

A,

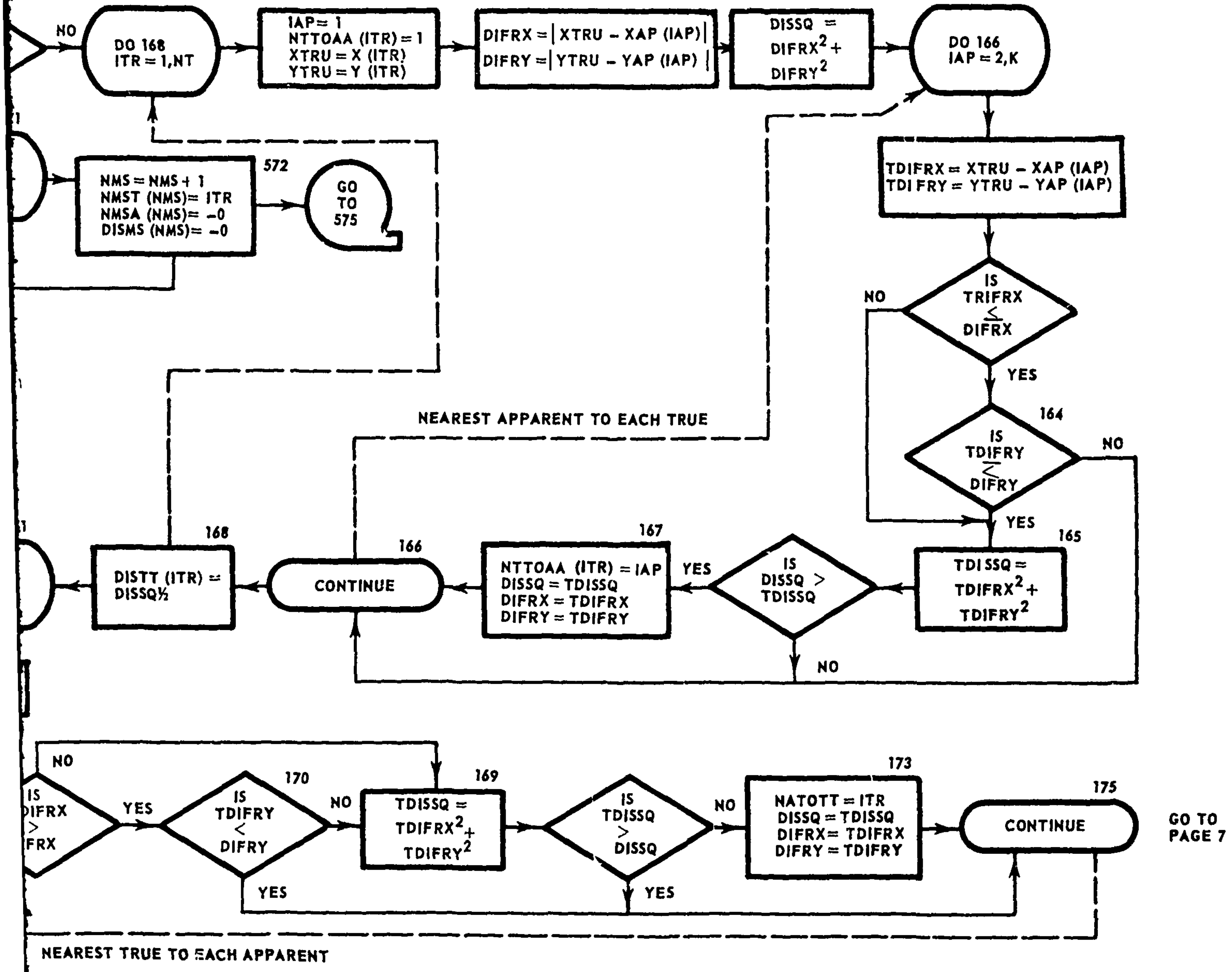
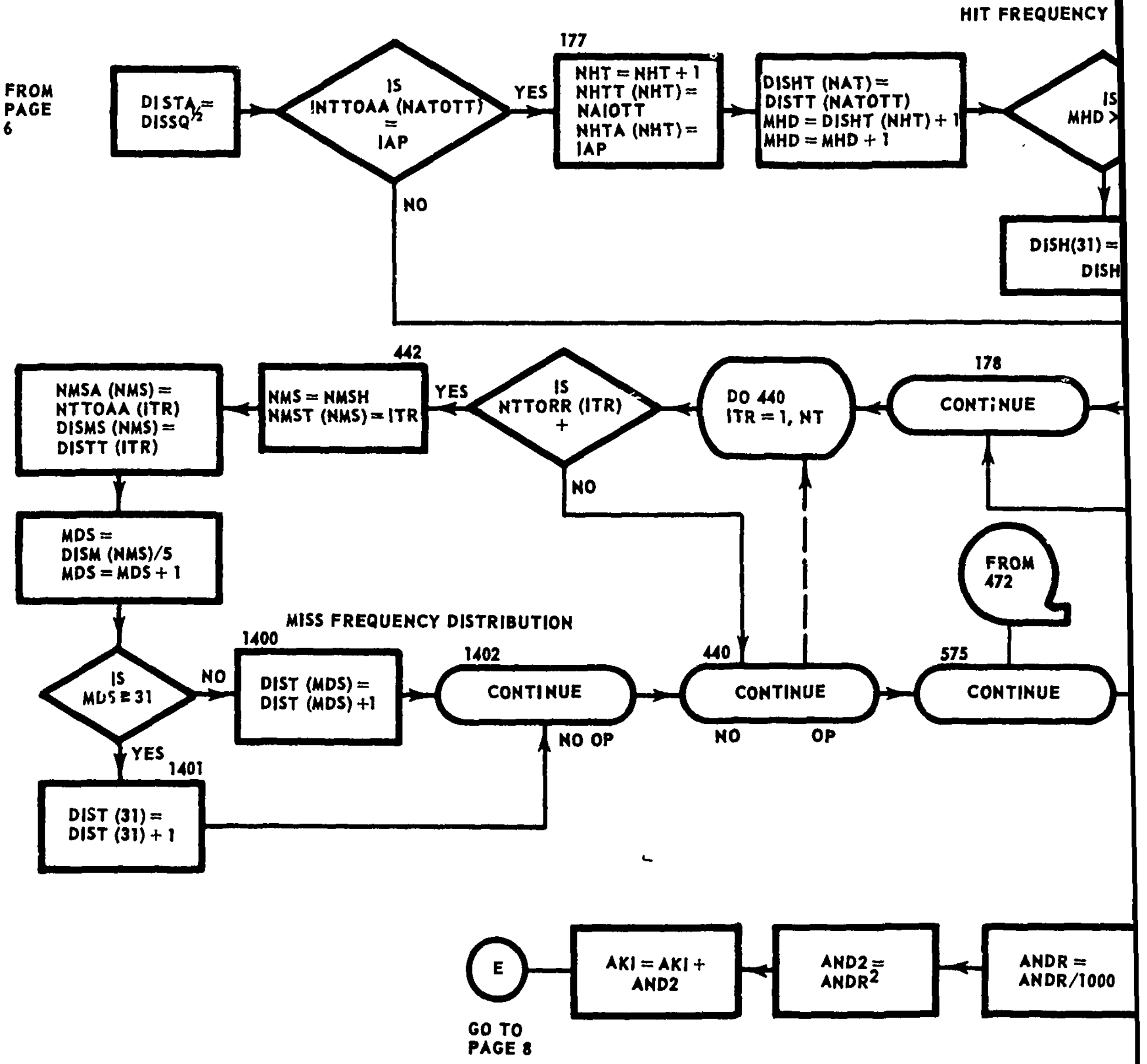


Figure 2-3 (Cont.)

B,


HIT FREQUENCY
FROM PAGE 6
DISTA = DISSQ$^{1/2}$
177
IS INTTOAA (NATOTT) = IAP
YES
NO
NHT = NHT + 1
NHTT (NHT) = NAIOTT
NHTA (NHT) = IAP
DISHT (NAT) = DISTT (NATOTT)
MHD = DISHT (NHT) + 1
MHD = MHD + 1
IS MHD >
DISH(31) = DISH
442
NMSA (NMS) = NTTOAA (ITR)
DISMS (NMS) = DISTT (ITR)
NMS = NMSH
NMST (NMS) = ITR
YES
IS NTTORR (ITR) +
NO
DO 440 ITR = 1, NT
178
CONTINUE
MDS = DISM (NMS)/5
MDS = MDS + 1
FROM 472
MISS FREQUENCY DISTRIBUTION
1400
1402
440
575
IS MDS ≥ 31
NO
DIST (MDS) = DIST (MDS) +1
CONTINUE
CONTINUE
CONTINUE
NO OP
NO
OP
YES
1401
DIST (31) = DIST (31) + 1
E
GO TO PAGE 8
AKI = AKI + AND2
AND2 = ANDR^2
ANDR = ANDR/1000

A 1

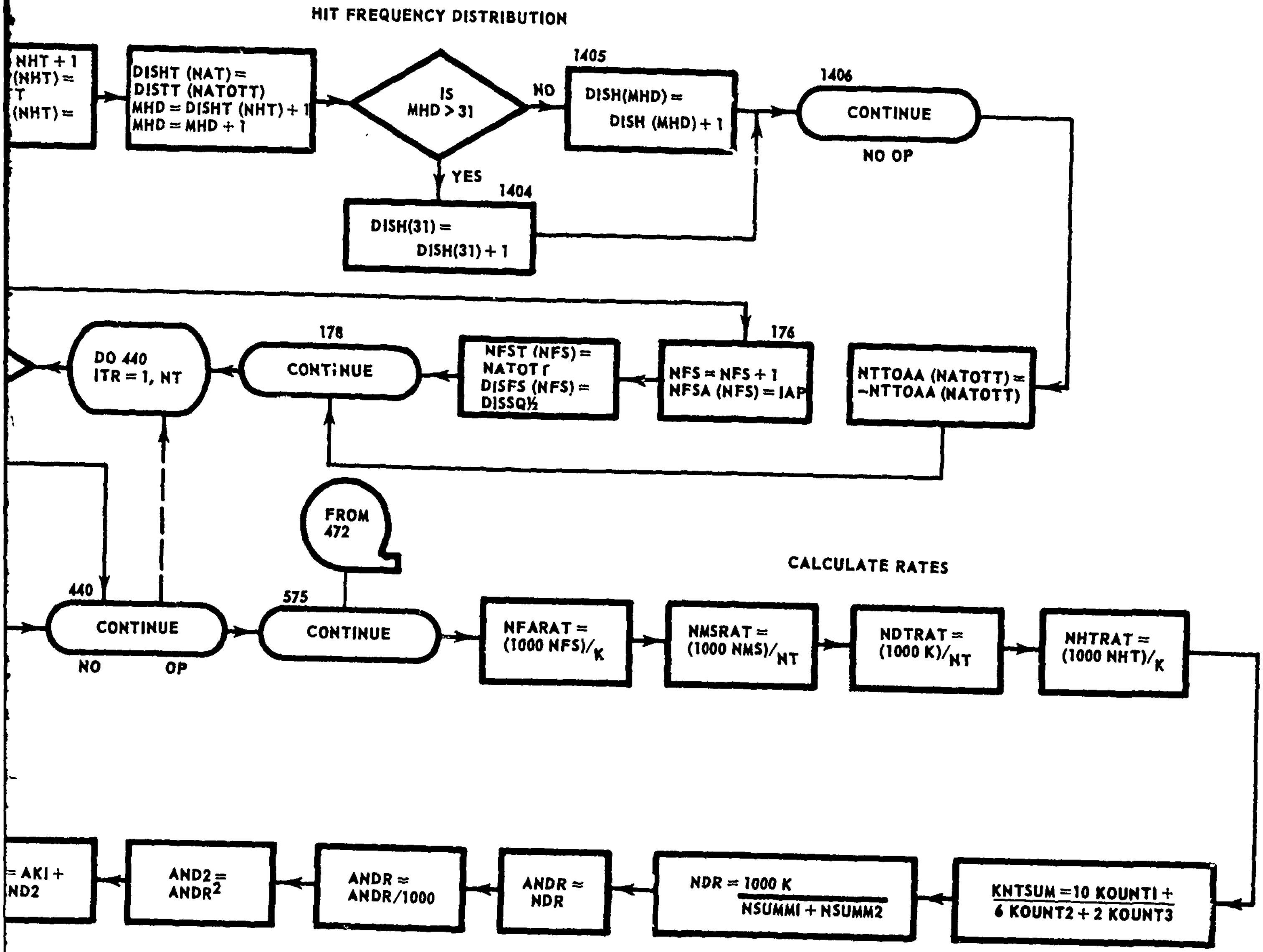
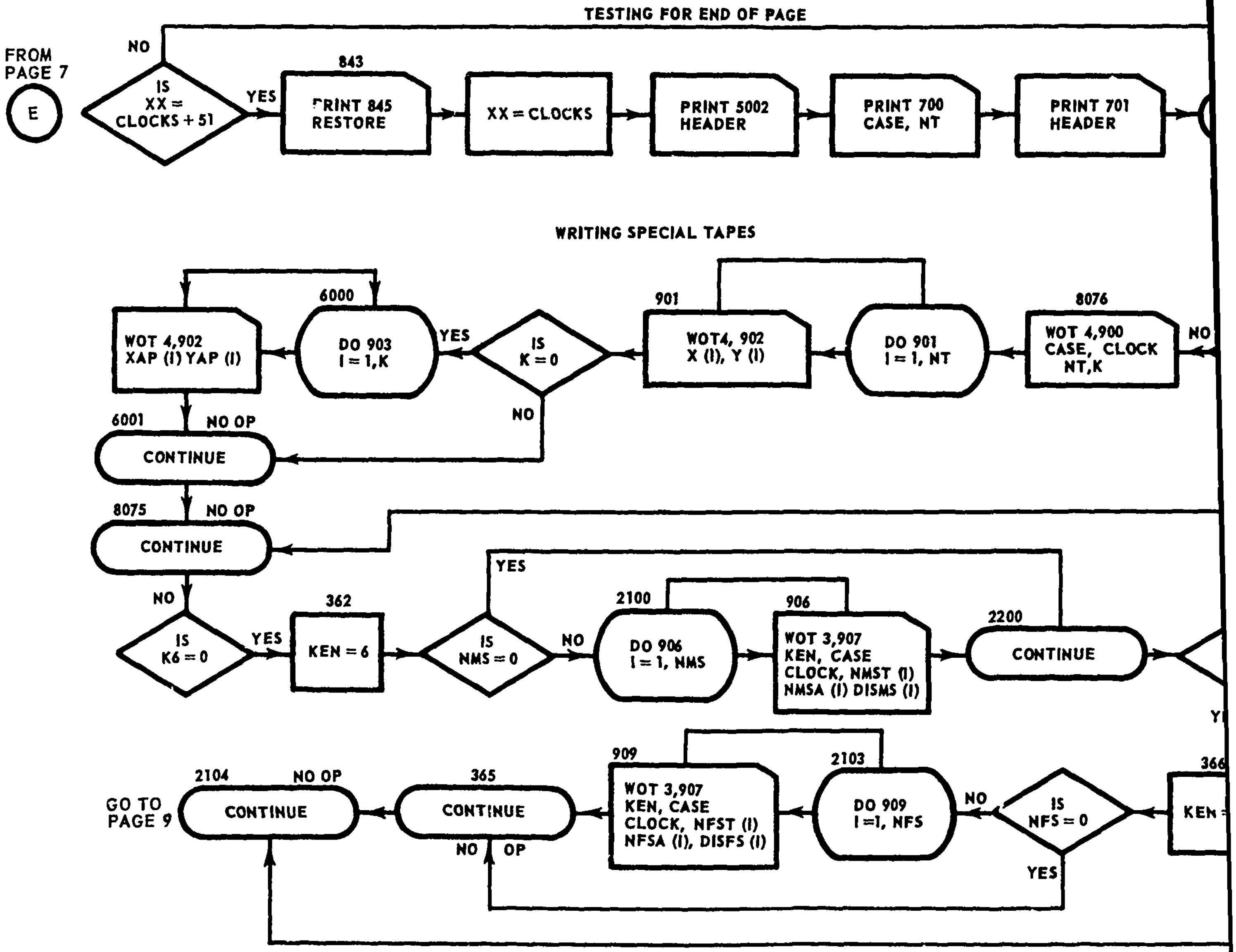


Figure 2-3 (Cont.)

B


TESTING FOR END OF PAGE
FROM PAGE 7
E
NO
IS XX = CLOCKS + 51
YES
843
PRINT 845 RESTORE
XX = CLOCKS
PRINT 5002 HEADER
PRINT 700 CASE, NT
PRINT 701 HEADER
WRITING SPECIAL TAPES
6000
WOT 4,902 XAP (I) YAP (I)
DO 903 I = 1,K
YES
IS K = 0
NO
901
WOT4, 902 X (I), Y (I)
DO 901 I = 1, NT
8076
WOT 4,900 CASE, CLOCK NT,K
NO
6001
NO OP
CONTINUE
8075
NO OP
CONTINUE
NO
IS K6 = 0
YES
362
KEN = 6
YES
IS NMS = 0
NO
2100
DO 906 I = 1, NMS
906
WOT 3,907 KEN, CASE CLOCK, NMST (I) NMSA (I) DISMS (I)
2200
CONTINUE
Y
909
2103
366
2104
NO OP
365
GO TO PAGE 9
CONTINUE
CONTINUE
NO OP
WOT 3,907 KEN, CASE CLOCK, NFST (I) NFSA (I), DISFS (I)
DO 909 I =1, NFS
NO
IS NFS = 0
YES
KEN

A1

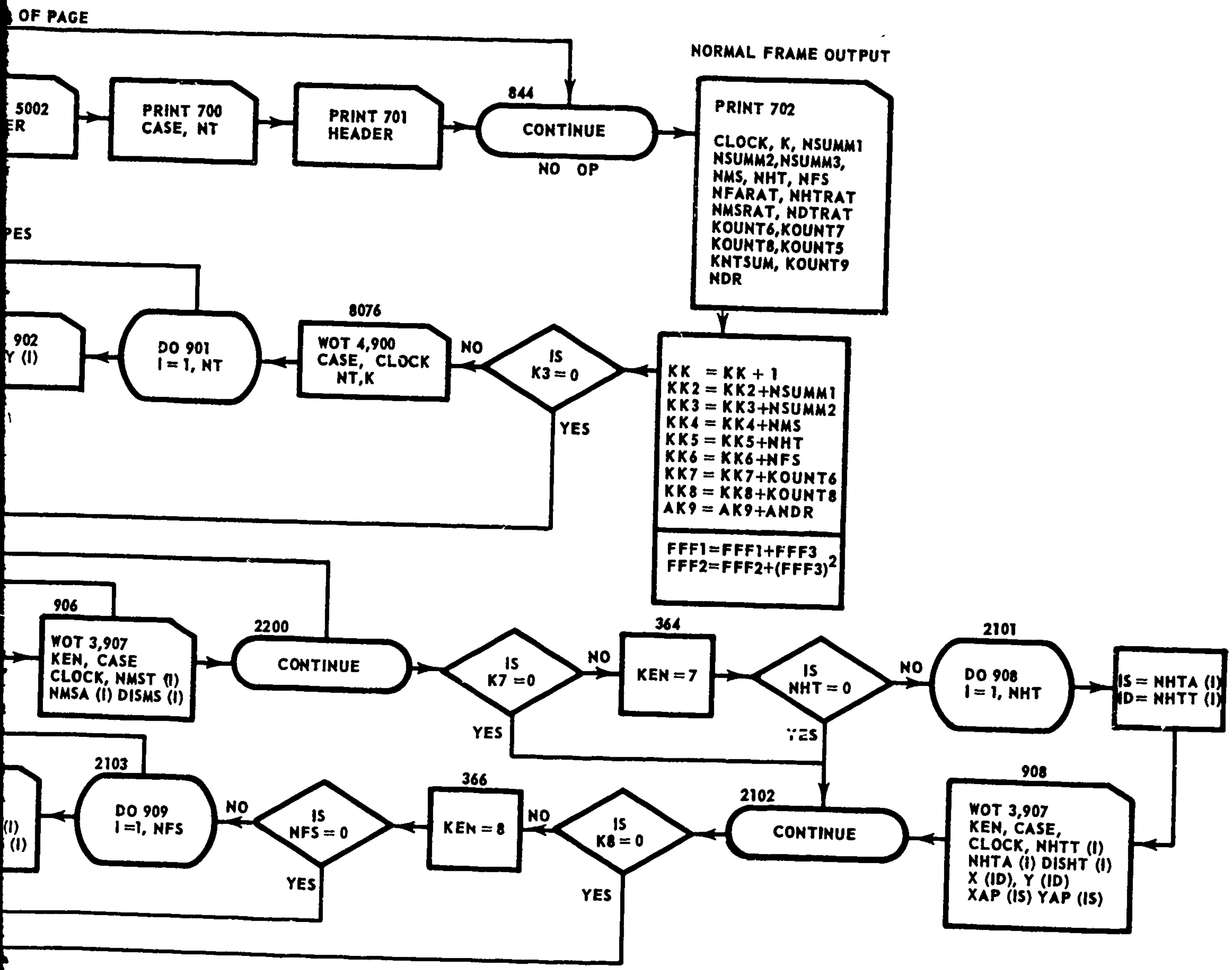
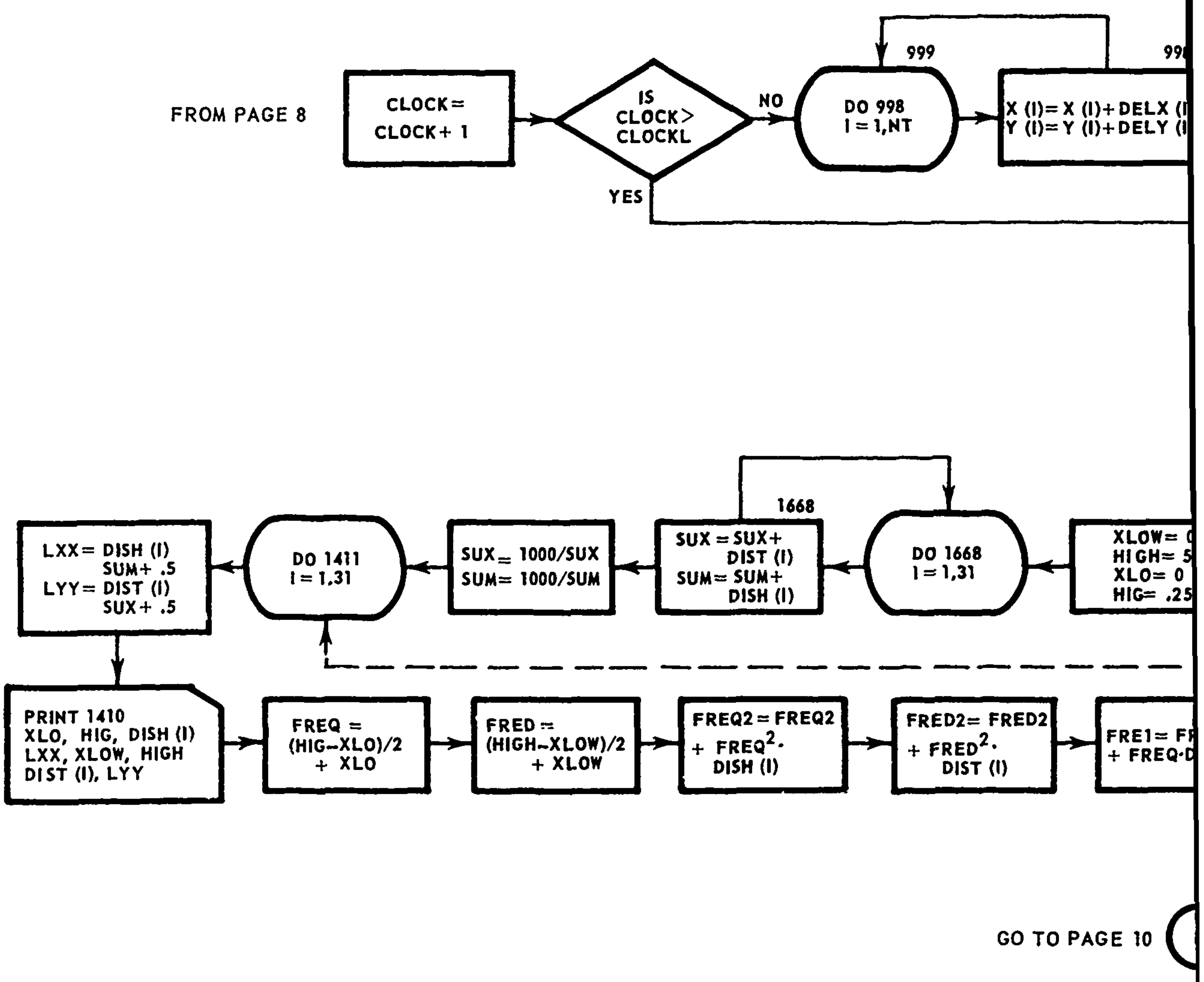


Figure 2-3 (Cont.)

B.

TEST IF ALL FRAMES ARE DONE



A,

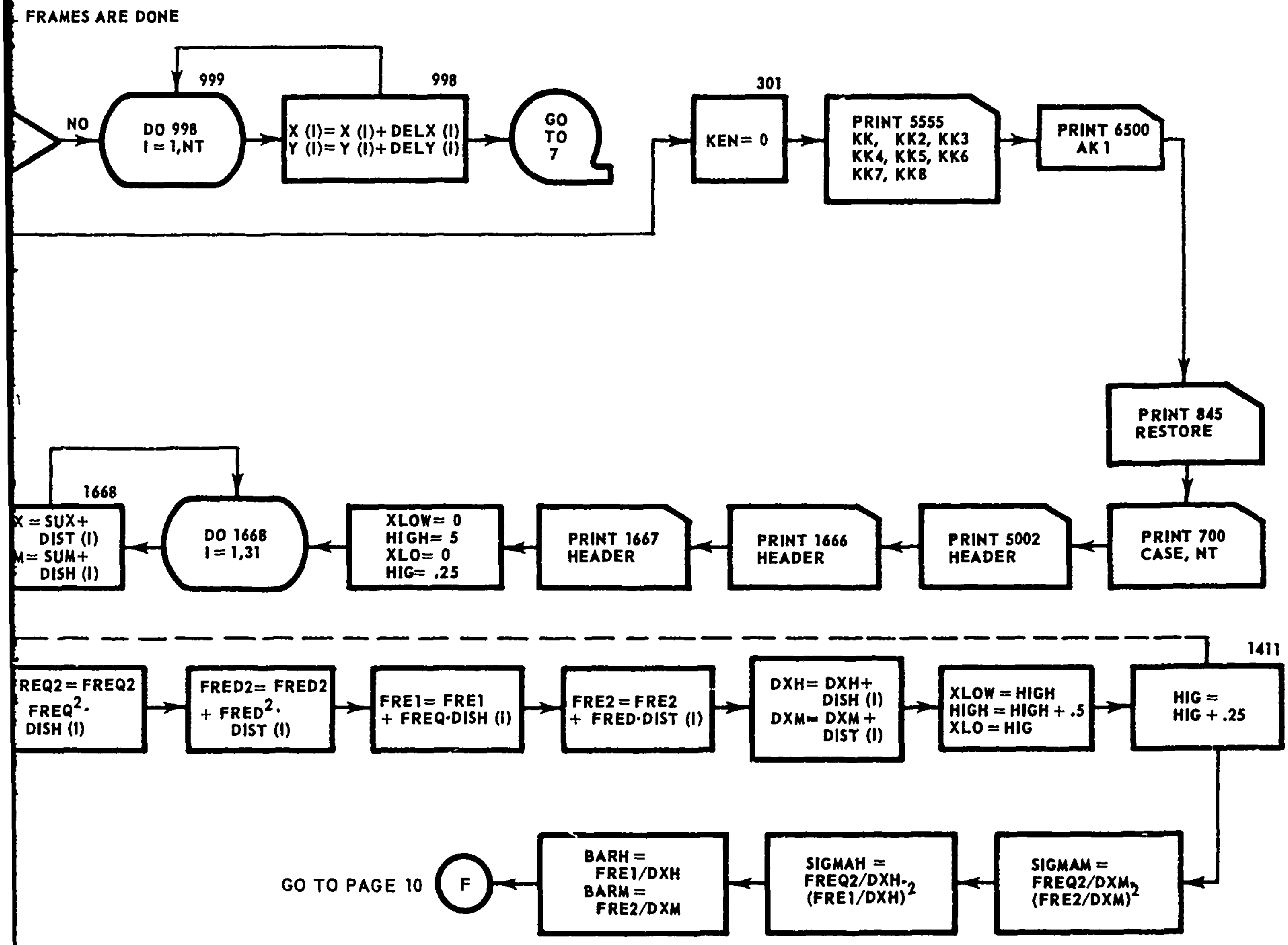


Figure 2-3 (Cont.)

B.

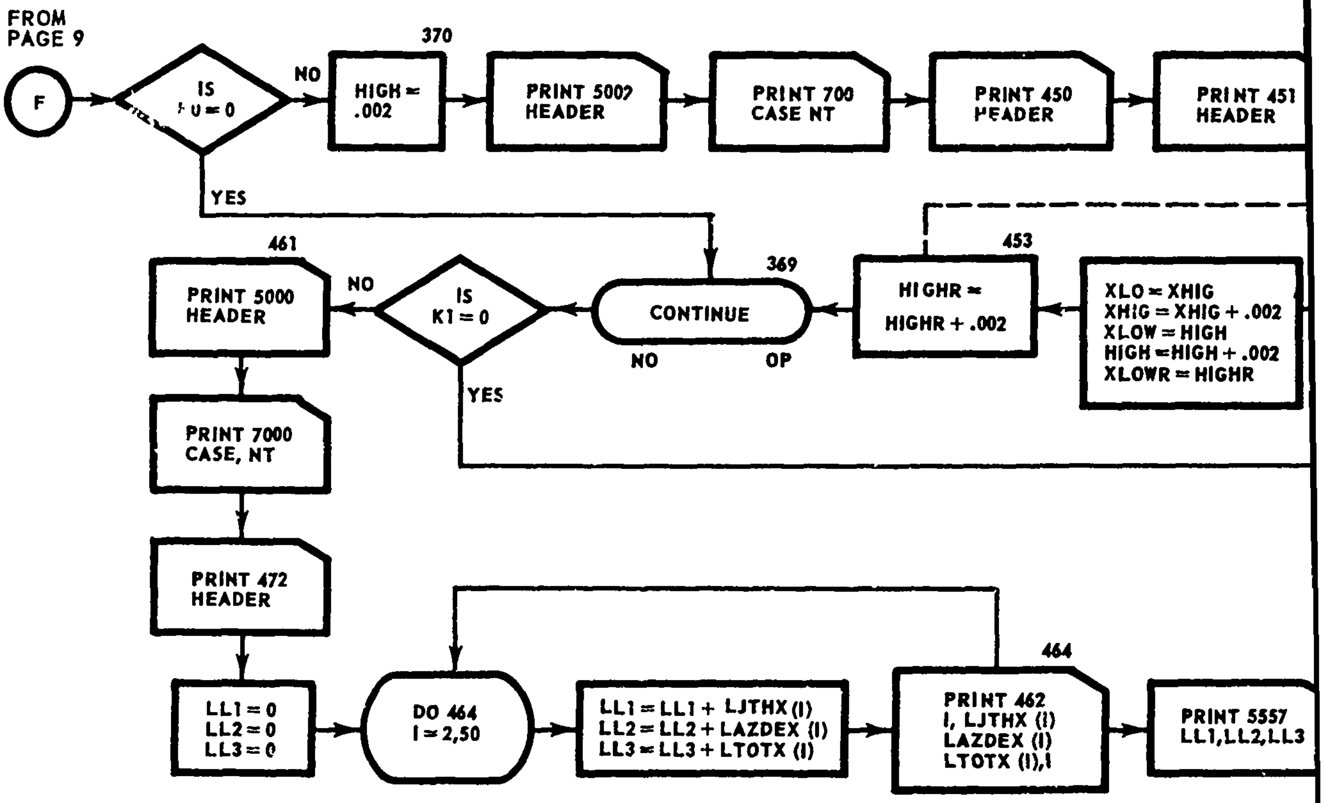


Figure 2-3 (Cont.)

A.

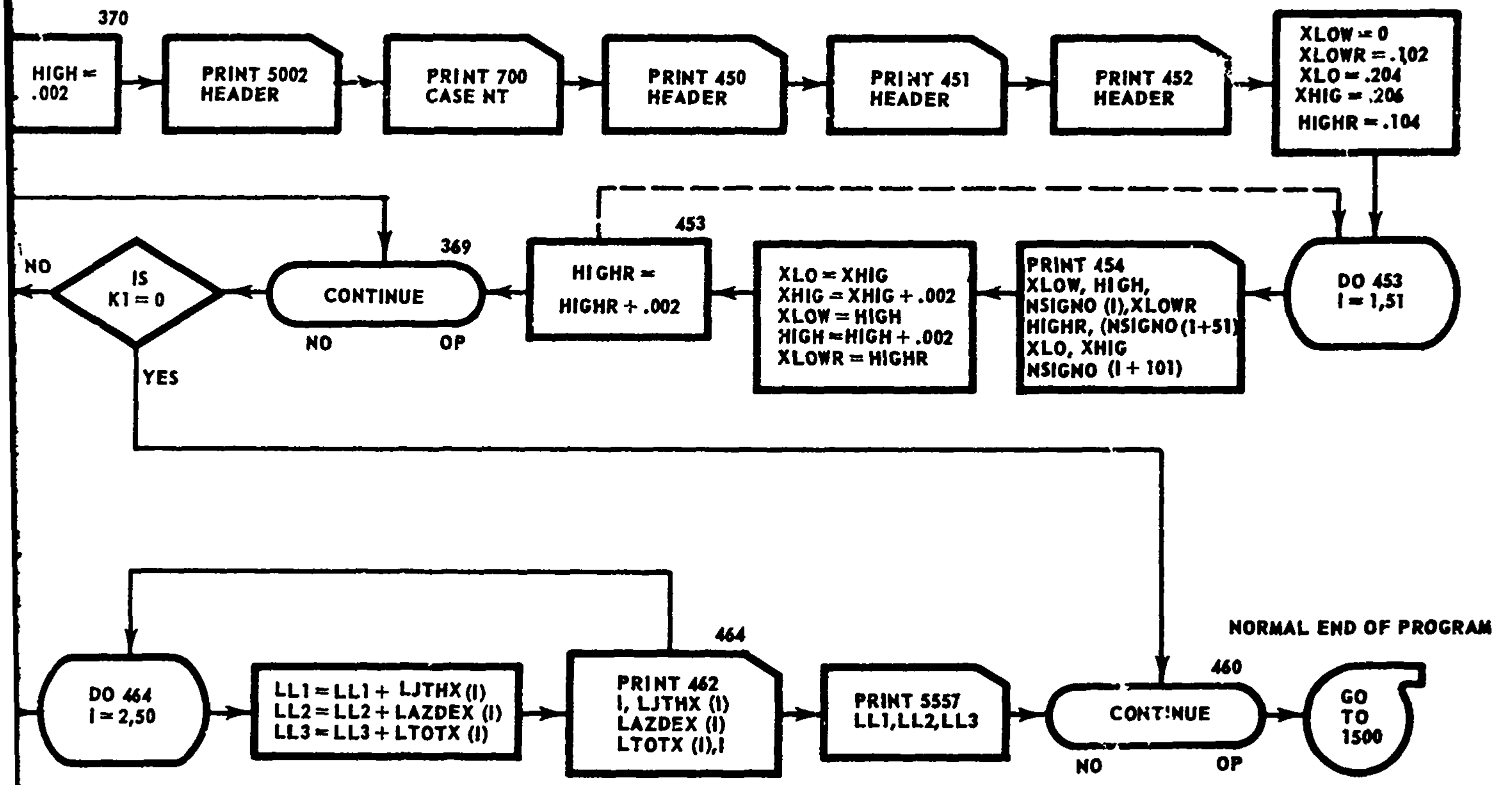


Figure 2-3 (Cont.)

B.

2.4 MODIFICATION TO OBTAIN MISS-DISTANCE

The function of this sub-program is to read one or more of the binary tapes produced by the continuity sub-program and to compute and make entires in the two-dimensional RAnge/AZimuth frequency table. This frequency table may be thought of as a ruled plane resembling a "checker board." The horizontal dimensions will be in terms of RAnge intervals while the vertical scaling will be in terms of AZimuth. Any particular block thus, represents a specific "closed" interval of range and azimuth. If each RA/AZ block ruled so that it contains three separate lines for three specific entries, then each detected target will have range and azimuth values that will define the target into one of the RA/AZ blocks in the RA/AZ frequency table. The program examines the range and azimuth of each detected target and makes an entry into the first line of the corresponding block in the frequency table. This first line in each block, XOBSVN, is a count of the detected targets which appear in the defined RA/AZ block for a specific analysis. The remaining two lines contain the arithmetic mean of the summation and the standard deviation respectively of either of three particular variables depending on the input control constant. These "mean" and "deviation" values may be functions of one of the following:

1. The difference between the true and the apparent target in a "hit pair"

2. The difference between the ranges of the true and the apparent target in a "hit pair"

3. The difference between the azimuths of the true target and the apparent target in a "hit pair"

The precise content of "mean" and "deviation" is a function of the control constant, K1, which is read in at the start of each analysis.

The program reads the input that indicates which binary tape to process (CASE 2), the initial frame (START 2), and the end frame (END 2); it then initiates a "search tape 4 routine" to select the desired starting point on the input tape. Each individual detected target is examined and entries are made into each of the three respective lines in the corresponding RA/AZ block. Upon processing the frame information, a test is made to determine if the last frame has been processed. If the last frame has not been processed. the program recycles back to read another frame from tape and processes this as described above. When the last frame has been processed, the program enters the "output sections." The RA/AZ frequency table (discussed previously) is printed on-line and punched onto cards.

2.4.1 Glossary

AMAZ	Arithmetic mean of the azimuth error in (radians)
AMMD	Arithmetic mean of miss distance in (nautical miles)
AMRE	Arithmetic mean of the range error in (nautical (miles)
AND	The summation of the NDR's
AND2	The summation of the squares of NDR
ANDR	NDR expressed in floating point
AZD	The absolute difference in azimuth between a true target and its associated apparents
AZTHER	The summation of the azimuth error for a given Jth target
AZTHSQ	The summation of the squares of the azimuths for a given Jth target
DIST	The distance between a true and its apparent target
DMISSQ	The summation of the squares of the miss distance for a given Jth target
DMISSR	The summation of the miss distances for a given Jth target

<u>FRQOBS</u>	Frequency of observation (i.e., how many times the J^{th} target was detected)
<u>MONTH</u>	The number of the month
<u>NDAY</u>	The day of the month
<u>NYEAR</u>	The last two digits of the year
<u>RNGER</u>	The summation of the range errors for a given Jth target
<u>RNGSQ</u>	The summation of the squares of the range errors for a given Jth target
<u>STDAZ</u>	The standard deviation of azimuth error
<u>STDMD</u>	The standard deviation of the miss distance
<u>STDRE</u>	The standard deviation of the range error
<u>VARAZ</u>	The variance of the azimuth error calculated by the formula $\zeta^2 = \frac{N \Sigma X^2 - (\Sigma X)^2}{N (N - 1)}$
<u>VARMD</u>	The variance of the miss distance
<u>VARRE</u>	The variance of the range error

2.4.2 FORTRAN Listing

```
      DIMENSION LJTH(50),LAZ(50),LAZDEL(50),LTOT(50)
      DIMENSION X(100),Y(100),M(100),DIFX(100),DIFY(100),RO(100),R2(100)
     1         ,DELY(100),AZ(100),NRESOL(100),FRQOBS(100),DMISSR(100),
     2DMISSQ(100),RNGER(100),RNGSQ(100),AZTHER(100),AZTHSQ(100),R1(100)
      DIMENSION DELX(100)
      READ 5050,MONTH,NDAY,NYEAR
1500  DO 5333 I=1,100
      FRQOBS(I)=0.
      DMISSR(I)=0.
      DMISSQ(I)=0.
      RNGER(I)=0.
      RNGSQ(I)=0.
      AZTHER(I)=0.
5333  AZTHSQ(I)=0.
      AND=0.
      AND2=0.
5050  FORMAT(3I2)
      PRINT 845,MONTH,NDAY,NYEAR
      O=0.
      READ 3,NT,KLOCKL,CASE,GAIN
3     FORMAT(2I5,2F10.1)
      READ 400,AZMUL,DELMUL,AZRES,DELRES,RMAX,RMIN,RMIN2
400   FORMAT(7F10.1)
      PRINT 5002
5002  FORMAT(78H       AN/TLQ-8 SIMULATION  MEASURES OF MISS DISTANCES
     1   BSD  PROGRAM BX2055)
      PRINT 700,CASE,NT
700   FORMAT(11H       CASE F5.0, 6H   NT I5)
      PRINT 1100,KLOCKL,AZMUL,DELMUL,AZRES,DFLRES
1100  FORMAT(12H       CLOCKLI4,7H AZMUL F9.6,7H DELMULF7.4,6H AZRESF9.6
     1,7H DELRESF7.4)
      PRINT 1101,GAIN,RMAX,RMIN,RMIN2
1101  FORMAT(10H       GAINF7.4,5H RMAXF7.2,5H RMINF6.2,6H RMIN2F9.6)
      PRINT 905
905   FORMAT(96H   FRAME  APPS NSUMM1 NSUMM2 NSUMM3  NDTRAT  KOUNT6  KOU
     1NT7  KOUNT8  KOUNT5  KNTSUM  KOUNT9  NDR  )
      READ 4,((X(I),Y(I),DELX(I),DELY(I)),I=1,NT)
4     FORMAT(4F10.2)
      XO=500.
      YO=500.
      X1=456.6985
      X2=475.
      Y1=475.
      Y2=543.3015
      KK=0
      XX=0.
      KK2=0
          FORTRAN LISTING PAGE 2

      KK3=0
      KK7=0
      KK8=0
      KK9=0
      KLOCK=0
7     KOUNT1=0
      KOUNT2=0
      KOUNT3=0
      KOUNT4=0
      KOUNT5=0
      KOUNT6=0
      KOUNT8=0
      KOUNT9=0
      NSUMM1=0
      NSUMM2=0
      NSUMM3=0
      SUMLO=0.
      SUMO =0.
      SUML1=0.
      SUML2=0.
      DO 50 I=1,NT
      DIFX(I)=X(I)-XO
      DIFY(I)=Y(I)-YO
      RO(I)=SQRTF(DIFX(I)**2+DIFY(I)**2)
      IF(RO(I)-RMAX) 9,9,8
9     IF(RO(I)-RMIN) 500,500,501
500   SUMLO=SUMLO+RMIN2
      GO TO 502
501     SUMLO=SUMLO+1./RO(I)**2
502    SUMO=SUMO+1./RO(I)**2
8     R1(I)=SQRTF((X(I)-X1)**2+(Y(I)-Y1)**2)
      IF(R1(I)-RMAX) 11,11,650
11    IF(R1(I)-RMIN) 652,651,651
651   SUML1=SUML1+1./R1(I)**2
      GO TO 650
652    SUML1=SUML1+RMIN2
650   CONTINUE
13    R2(I)=SQRTF((X(I)-X2)**2+(Y(I)-Y2)**2)
      IF(R2(I)-RMAX) 15,15,660
15    IF(R2(I)-RMIN) 662,661,661
661   SUML2=SUML2+1./R2(I)**2
      GO TO 660
662   SUML2=SUML2+RMIN2
660   CONTINUE
      IF(DIFY(I)) 18,18,19
          FORTRAN LISTING PAGE 3

18    M(I)=3
      NSUMM3=NSUMM3+1
      GO TO 50
19    IF(RO(I)-RMAX) 40,40,22
 40   IF(DIFX(I))20,23,23
20    IF(R1(I)-RMAX) 21,21,22
22    M(I)=4
      GO TO 50
21    M(I)=1
      NSUMM1=NSUMM1+1
      GO TO 26
23    IF(R2(I)-RMAX) 25,25,22
```

```
 25    M(I)=2
       NSUMM2=NSUMM2+1
 26    AZ(I)=ATN1F(DIFY(I),-DIFX(I))
 50    CONTINUE
       DO 56 I=1,50
       LJTH(I)=0
        LAZ(I)=0
       LAZDEL(I)=0
 56    LTOT(I)=0
       K=0
       LINDX=0
       DO 100 J=1,NT
       IF(M(J)) 100,58,58
 58    IF(XABSF(M(J))-2) 60,60,100
 60    L=0
       DO 76 I=1,NT
       IF(XABSF(M(I))-XABSF(M(J))) 76,62,76
  62   IF((ABSF(AZ(J)-AZ(I)))-AZRES) 64,64,76
 64    L=L+1
       NRESOL(L)=I
 76    CONTINUE
 72    SIDLO=SUMO
       AMB=0.
       AMBL=0.
 74    IF(XABSF(M(J))-1) 75,71,75
 75    RADOMA=SUML2
       GO TO 77
 71    RADOMA=SUML1
 77    DO 88 I=1,L
       KBAS=NRESOL(I)
       FRACT=1./RO(KBAS)**2
       FLJ=1.-ABSF((AZ(J)-AZ(KBAS))/AZRES)
       AMB=AMB+FLJ*FRACT
       IF(FRACT-RMIN2) 275,275,274
           FORTRAN LISTING PAGE 4

 274   FRACT=RMIN2
 275   AMBL=AMBL+FLJ*FRACT
       IF(J-KBAS) 88,276,88
 276   TARGML=FRACT
       IF(XABSF(M(J))-1) 83,85,83
 83    IF(R2(KBAS)-RMIN) 680,680,681
 680   RANGMA=RMIN**2
       GO TO 682
 681   RANGMA=R2(KBAS)**2
  682  CONTINUE
       DELTA=RO(J)-R2(J)
       GO TO 88
 85    IF(R1(KBAS)-RMIN) 690,690,691
```

```
690     RANGMA=RMIN**2
        GO TO 692
691     RANGMA=R1(KBAS)**2
692     CONTINUE
        DELTA=RO(J)-R1(J)
88      CONTINUE
        IF(AMBL-(SUMO-AMB)*GAIN)4000,89,89
4000     KOUNT9=KOUNT9+1
        GO TO 100
89      AOSIGO=((SUMO-AMB)*GAIN+AMBL-TARGML)/TARGML
        AOSIGA=(RANGMA*RADOMA)-1.
        SIGNO=1./(2.+AOSIGO+AOSIGA+AOSIGO*AOSIGA)
        IF(SIGNO-.0112) 99,101,101
101     KOUNT1=KOUNT1+1
        GO TO 112
99      IF(SIGNO-.00841) 103,102,102
102     KOUNT2=KOUNT2+1
        IF(RAM2BF(0)-.6) 112,250,250
103     IF(SIGNO-.00631) 105,104,104
104      KOUNT3=KOUNT3+1
        IF(RAM2BF(0)-.2) 112,250,250
105      KOUNT4=KOUNT4+1
250     CONTINUE
        GO TO 100
112     KOUNT5=KOUNT5+1
        IF(L-1) 113,113,114
114     KOUNT6=KOUNT6+1
        LINDX=LINDX+1
        IF(LINDX-50) 73,73,122
73      LJTH(LINDX) =J
        LAZ(LINDX) =L
        GO TO 122
113     A2T=AZ (J)
            FORTRAN LISTING PAGE 5

115     ANO=(RAM2BF(0)-.5)*AZMUL
        A2T=A2T+ANO
        BNO=(RAM2BF(0)-.5)*DELMUL
        DELTA=DELTA+ BNO
        IF(XABSF(M(J))-1) 116,116,117
116     ANGLE=A2T+.5235988
        GO TO 118
117     ANGLE=A2T-1.0471976
118     RANGE=(2500.-DELTA**2)/(100.*COSF(ANGLE)-2.*DELTA)
1298    CONTINUE
        K=K+1
120      XAP    =XO-RANGE*COSF(A2T)
121     YAP    =YO+RANGE*SINF(A2T)
        IF(SENSE SWITCH 2 ) 1666,1667
1666    WRITE OUTPUT TAPE 4,1668,J,X(J) ,Y(J),RO(J),AZ(J),XAP,YAP,RANGE,A2
```

```
      1T
1668  FORMAT(I5,8E14.5)
1667   CONTINUE
      FRQOBS(J)= FRQOBS(J)+1.
      DIST= SQRTF((X(J)-XAP   )**2+(Y(J)-YAP   )**2)
      DMISSQ(J)= DMISSQ(J) + DIST**2
      DMISSR(J)= DMISSR(J) + DIST
      RD= ABSF(RO(J)-RANGE)
      RNGER(J)=RNGER(J)+RD
      RNGSQ(J)=RNGSQ(J)+RD**2
      AZD= ABSF(AZ(J)-AZT)
      AZTHER(J)=AZTHER(J)+AZD
      AZTHSQ(J)=AZTHSQ(J)+AZD**2
      IF(SENSE SWITCH 1) 1400,1401
1400  PUNCH 912,CASE,KLOCK,J,RO(J),AZ(J),DIST,RD,AZD
1401  CONTINUE
912   FORMAT(F8.0,I5,I4,F10.3,F10.6,F11.5,F11.5,F10.6)
      GO TO 100
122   NEEL=0
      DO 130 I=1,L
      KBAS=NRESOL(I)
      IF(XABSF(M(J))-1)  123,123,124
124   IF(ABSF(RO(KBAS)-R2(KBAS)-DELTA)-DELRES) 127,127,130
123   IF(ABSF(RO(KBAS)-R1(KBAS)-DELTA)-DELRES) 127,127,130
127   NEEL=NEEL+1
      M(KBAS)=-M(KBAS)
      NRESOL(NEEL)=NRESOL(I)
130   CONTINUE
      IF(NEEL-1) 517,517,132
517   KOUNT8=KOUNT8+1
      IF(LINDX-50)7000,7000,113
          FORTRAN LISTING PAGE 6

7000  LAZDEL(LINDX)=1
      LTOT(LINDX)=1
      GO TO 113
 132  KLOO=1
      IF(LINDX-50)133,133,134
133   LAZDEL(LINDX)=NEEL
134   IF(NRESOL(KLOO)-J) 135,150,135
135   IND=NRESOL(KLOO)
      IF(XABSF(M(J))-1) 136,136,137
136   ADELTA=RO(IND)-R1(IND)
      GO TO 140
137   ADELTA=RO(IND)-R2(IND)
140   DO 149 I=1,NT
      IF(M(I)) 149,777,777
777   IF(XABSF(M(I ))-XABSF(M(J)))149,141,149
```

```
141     IF(ABSF(AZ(I)-AZ(KLOO))-AZRES) 142,142,149
142    IF(XABSF(M(J))-1) 146,146,143
146    IF(ABSF(RO(I)-R1(I)-ADELTA)-DELRES) 144,144,149
144     NEEL=NEEL+1
       NRESOL(NEEL)=I
       M(I)=-M(I)
       GO TO 149
143    IF(ABSF(RO(I)-R2(I)-ADELTA)-DELRES) 144,144,149
149    CONTINUE
150    KLOO=KLOO+1
       IF(KLOO-NEFL) 134,134,152
152    IF(LINDX-50)155,155,156
155    LTOT(LINDX)=NEEL
156    SUMAZ=0.
       DENOM=NEEL
       KOUNT7=KOUNT7+NEEL
       A2T=0.
       DO 160 I=1,NEEL
       KBAS=NRESOL(I)
       IF(AZ(KBAS)-A2T) 160,160,277
277    A2T=AZ(KBAS)
       IF(XABSF(M(J))-1)278,278,279
278    DELTA=RO(KBAS)-R1(KBAS)
       GO TO 160
279    DELTA=RO(KBAS)-R2(KBAS)
160    CONTINUE
       GO TO 115
100    CONTINUE
       NDTRAT=(1000*K)/NT
       KNTSUM=10*KOUNT1+6*KOUNT2+2*KOUNT3
       NDR=(1000*K)/(NSUMM1+NSUMM2)
           FORTRAN LISTING PAGE 7

       XX=XX+1.
       IF(XX-52.) 571,571,570
570    PRINT 845,MONTH,NDAY,NYEAR
       PRINT905
       XX=0.
571    PRINT 906,KLOCK,K,NSUMM1,NSUMM2,NSUMM3,NDTRAT,KOUNT6,KOUNT7,KOUNT8
      1,KOUNT5.KNTSUM,KOUNT9,NDR
906    FORMAT(I6,4I7,7I8,I6)
       KK=KK+K
       KK2=KK2+NSUMM1
       KK3=KK3+NSUMM2
       KK7=KK7+KOUNT6
       KK8=KK8+KOUNT8
       KK9=KK9+KOUNT9
       ANDR=NDR
       ANDR=ANDR/1000.
       AND2=AND2+ANDR**2
      AND=AND+ANDR
      KLOCK=KLOCK+1
      IF(KLOCK-KLOCKL) 949,949,950
949   DO 900 I=1,NT
      X(I)=X(I)+DELX(I)
900   Y(I)=Y(I)+DELY(I)
      GO TO 7
950   PRINT 907,KK,KK2,KK3,KK7,KK8,KK9,AND
907   FORMAT(7H TOTALSI6,2I7,I23,I16,I24,F9.3)
      PRINT 914,AND2
914   FORMAT(90H
     1                    SUM OF SQUARES NDR F11.6)
      PRINT 845,MONTH,NDAY,NYEAR
      PRINT 908
908   FORMAT(95H                                  MISS DISTANCE                    RANG
     1E ERROR                       AZIMUTH ERROR)
      PRINT 909
909   FORMAT(101H TARGET   FREQ OBS    MEAN      ST DEV     VAR          MEAN
     1     ST DEV     VAR          MEAN       ST DEV     VAR)
      DO 901 I=1,NT
      AMMD= DMISSR(I)/FRQOBS(I)
      VARMD=(FRQOBS(I)*DMISSQ(I)-DMISSR(I)**2)/(FRQOBS(I)*(FRQOBS(I)-1.)
     1)
      STDMD=SQRTF(VARMD)
      AMRE= RNGER(I)/FRQOBS(I)
      VARRE=(FRQOBS(I)*RNGSQ(I)-RNGER(I)**2)/(FRQOBS(I)*(FRQOBS(I)-1.))
      STDRE=SQRTF(VARRE)
      AMAZ=AZTHER(I)/FRQOBS(I)
      VARAZ=(FRQOBS(I)*AZTHSQ(I)-AZTHER(I)**2)/(FRQOBS(I)*(FRQOBS(I)-1.)
          FORTRAN LISTING PAGE 8

     1)
      STDAZ=SQRTF(VARAZ)
      PRINT 911,I,FRQOBS(I),AMMD,STDMD,VARMD,AMRE,STDRE,VARRE,AMAZ,STDAZ
     1,VARAZ
      PUNCH 913, CASE,I,RO(I),AZ(I),FRQOBS(I),DMISSR(I),DMISSQ(I),RNGER(
     1I),RNGSQ(I),AZTHER(I),AZTHSQ(I)
901   CONTINUE
      PRINT 959
      PAUSE 1
      GO TO 1500
959   FORMAT(83H NOTE  MEAN AND ST DEV OF AZIMUTH ERROR ARE MULTIPLIED B
     1Y 100  AND VARIANCE. BY 1000    )
845   FORMAT(108H1
     1                                                    DATE RUNI3,1H/I2,1H/I
     22)
911   FORMAT(I5,F10.0,F11.3,F10.3,F9.3,F11.3,F10.3,F9.3,2P2F10.6,3PF9.6)
913   FORMAT(F6.0,I3,F6.1,F7.4,F4.0,F7.1,F7.1,F9.4,F8.2,1PF7.4,2PF8.4)
      END(0,1,0,0,1)
```

FLOW DIAGRAM ERROR MEASURES

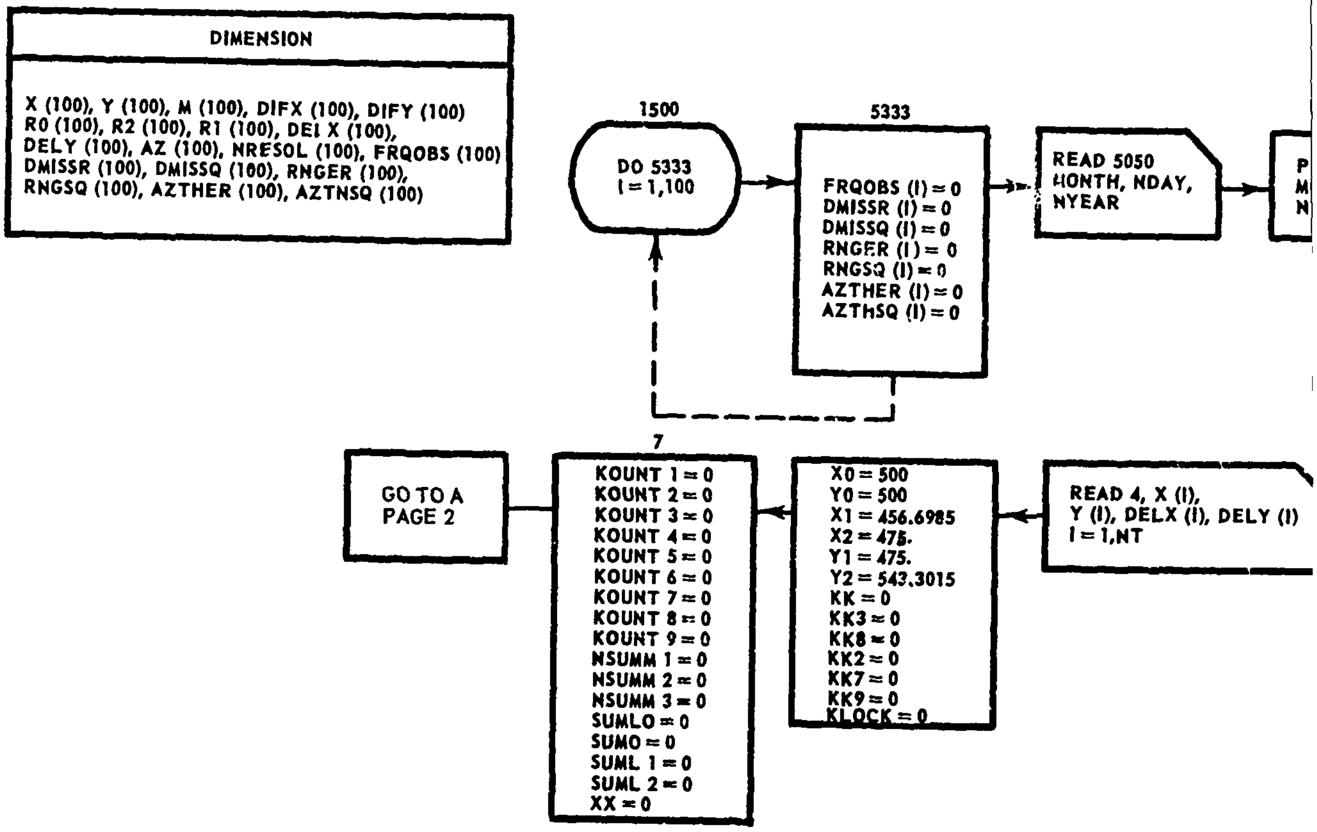


Figure 2-4 Flow Diagra

A,

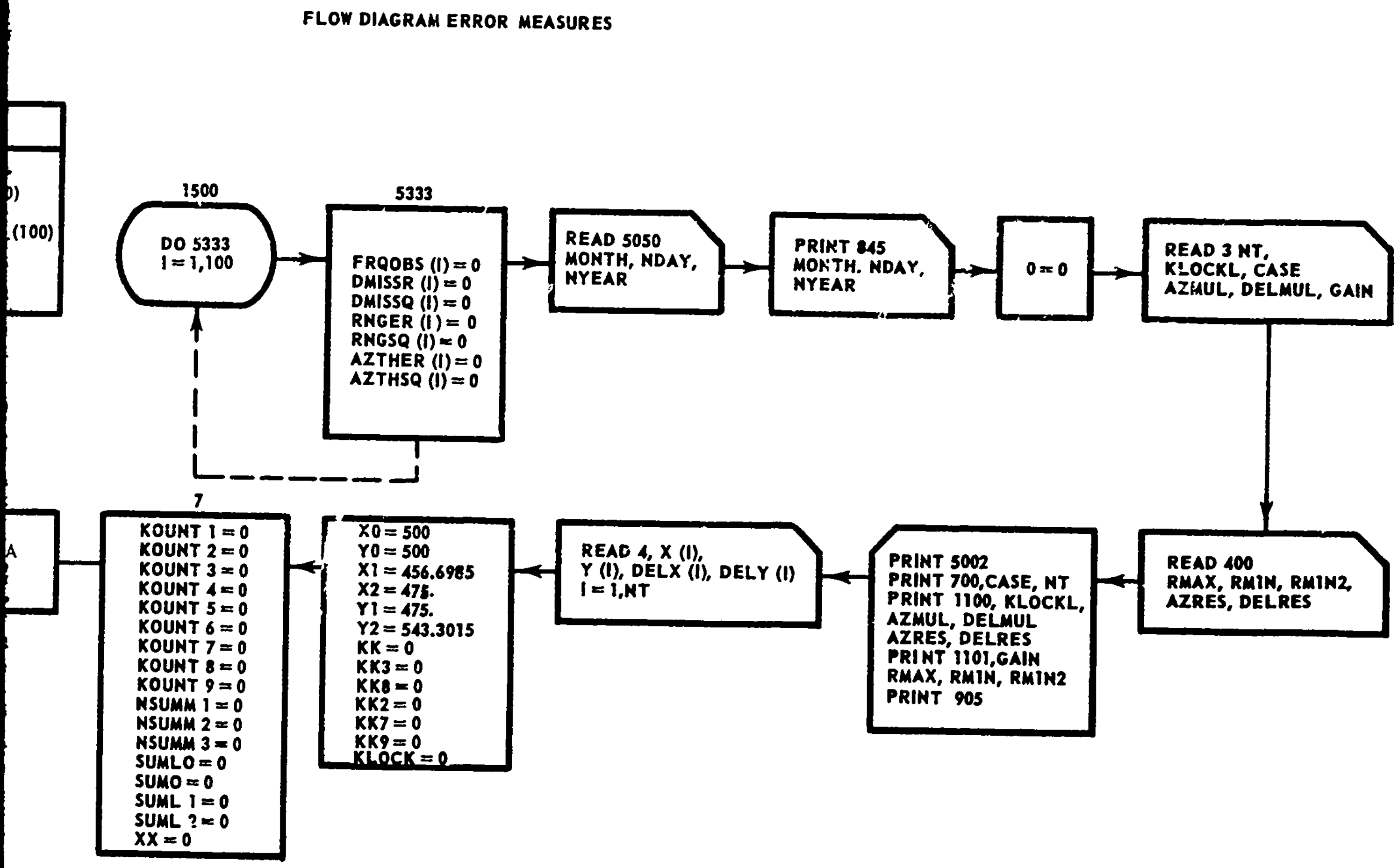
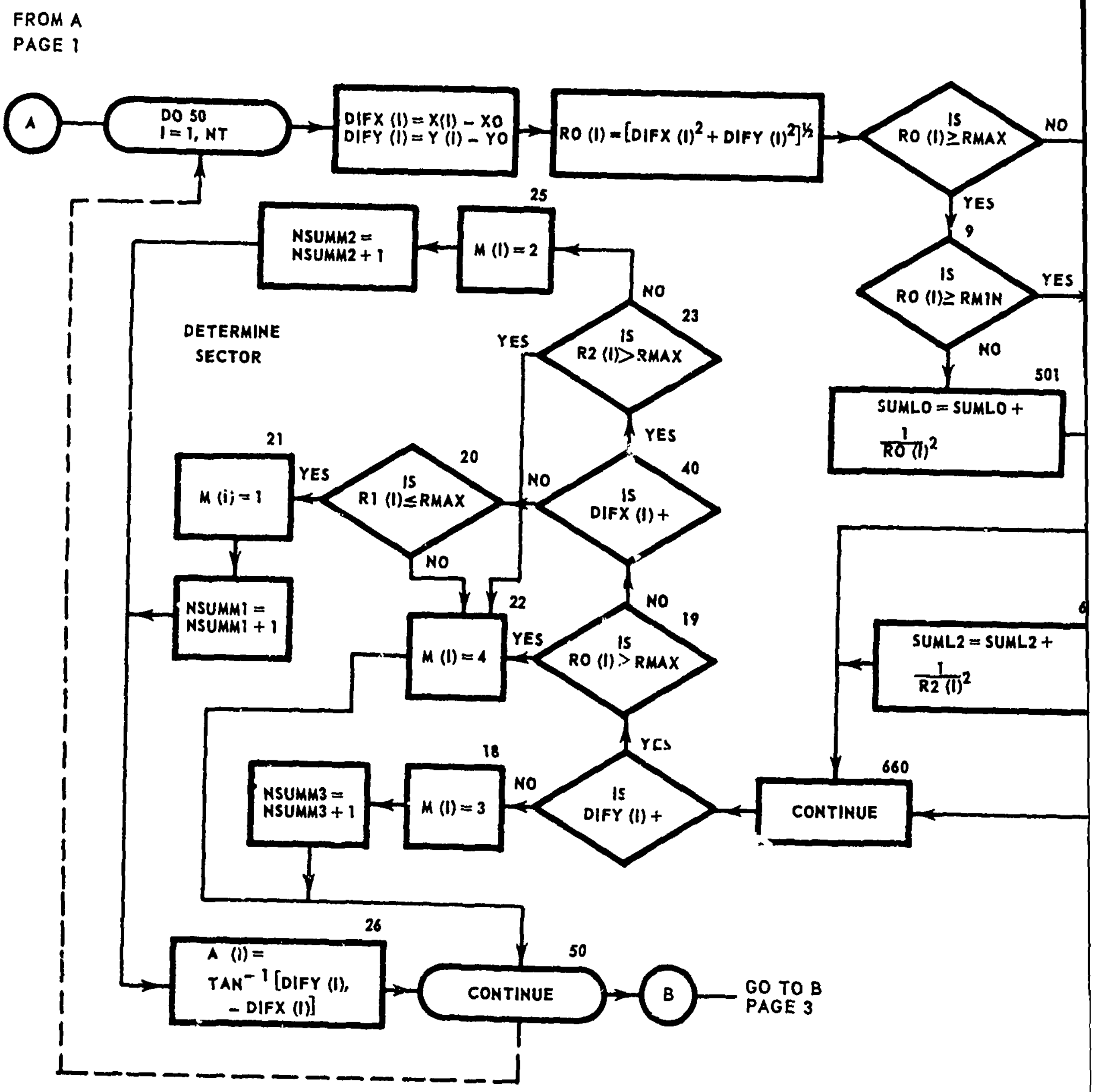


Figure 2-4 Flow Diagram Error Measures

B,


FROM A
PAGE 1
A
DO 50
I = 1, NT
DIFX (I) = X(I) – XO
DIFY (I) = Y (I) – YO
RO (I) = [DIFX (I)² + DIFY (I)²]½
IS
RO (I) ≥ RMAX
NO
YES
9
IS
RO (I) ≥ RMIN
YES
NO
501
SUMLO = SUMLO +
1/RO (I)²
25
NSUMM2 =
NSUMM2 + 1
M (I) = 2
NO
23
YES
IS
R2 (I) > RMAX
DETERMINE
SECTOR
YES
40
IS
DIFX (I) +
NO
21
YES
M (i) = 1
20
IS
R1 (I) ≤ RMAX
NO
NSUMM1 =
NSUMM1 + 1
22
M (I) = 4
YES
NO
19
IS
RO (I) > RMAX
YES
6
SUML2 = SUML2 +
1/R2 (I)²
18
NSUMM3 =
NSUMM3 + 1
M (I) = 3
NO
IS
DIFY (I) +
660
CONTINUE
26
A (I) =
TAN⁻¹ [DIFY (I),
– DIFX (I)]
50
CONTINUE
B
GO TO B
PAGE 3

A1

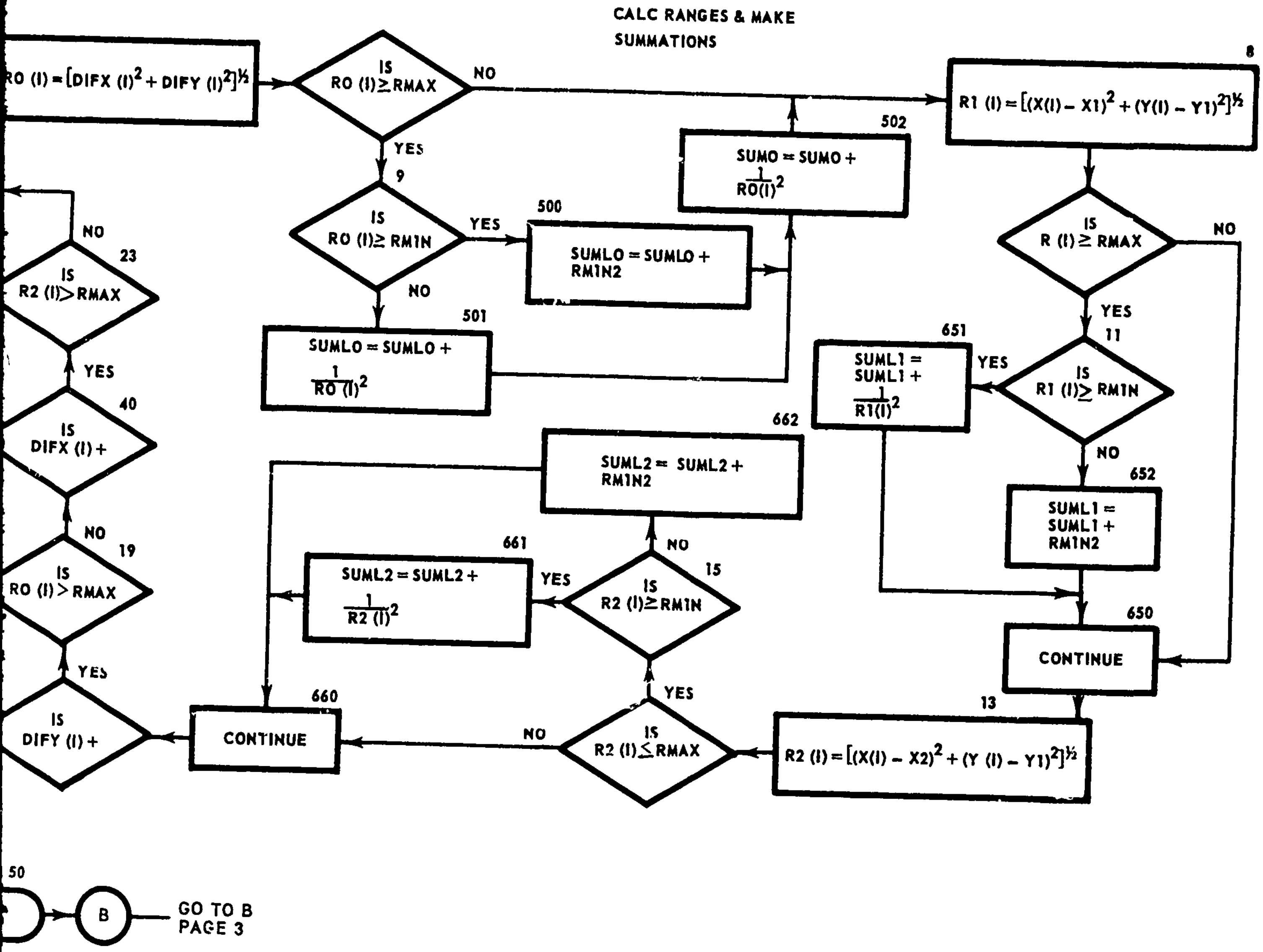
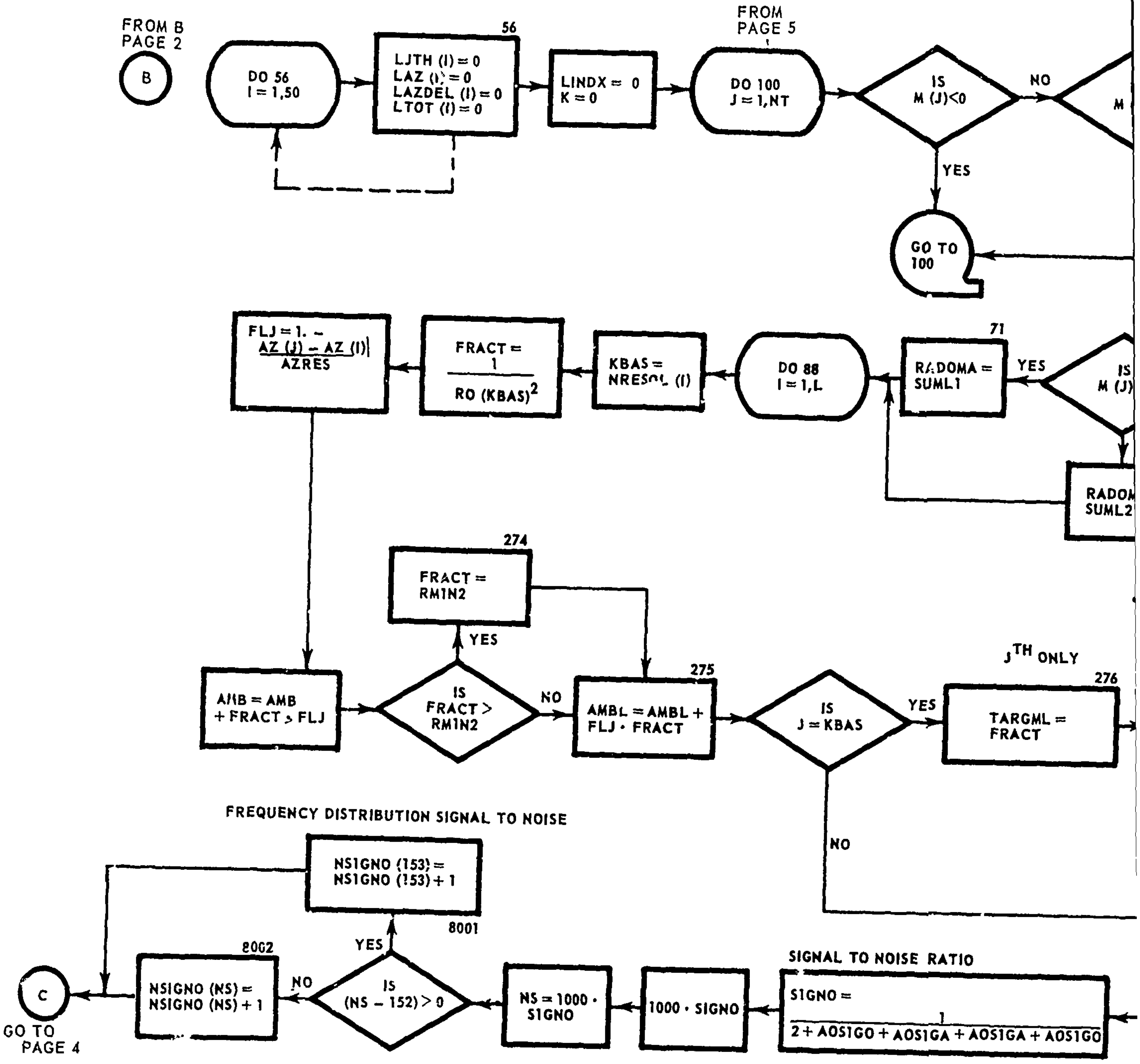


Figure 2-4 (Cont.)

B,


FROM B
PAGE 2
B
DO 56
I = 1,50
56
LJTH (I) = 0
LAZ (I) = 0
LAZDEL (I) = 0
LTOT (I) = 0
LINDX = 0
K = 0
FROM
PAGE 5
DO 100
J = 1,NT
IS
M (J)<0
NO
M
YES
GO TO
100
FLJ = 1. - |AZ (J) - AZ (I)| / AZRES
FRACT = 1 / RO (KBAS)^2
KBAS =
NRESOL (I)
DO 88
I = 1,L
71
RADOMA =
SUML1
YES
IS
M (J)
RADOM
SUML2
274
FRACT =
RMIN2
YES
AMB = AMB
+ FRACT x FLJ
IS
FRACT >
RMIN2
NO
275
AMBL = AMBL +
FLJ · FRACT
IS
J = KBAS
YES
JTH ONLY
276
TARGML =
FRACT
NO
FREQUENCY DISTRIBUTION SIGNAL TO NOISE
NSIGNO (153) =
NSIGNO (153) + 1
8001
YES
8002
C
GO TO
PAGE 4
NSIGNO (NS) =
NSIGNO (NS) + 1
NO
IS
(NS - 152) > 0
NS = 1000 ·
SIGNO
1000 · SIGNO
SIGNAL TO NOISE RATIO
SIGNO = 1 / 2 + AOSIGO + AOSIGA + AOSIGA + AOSIGO

A.

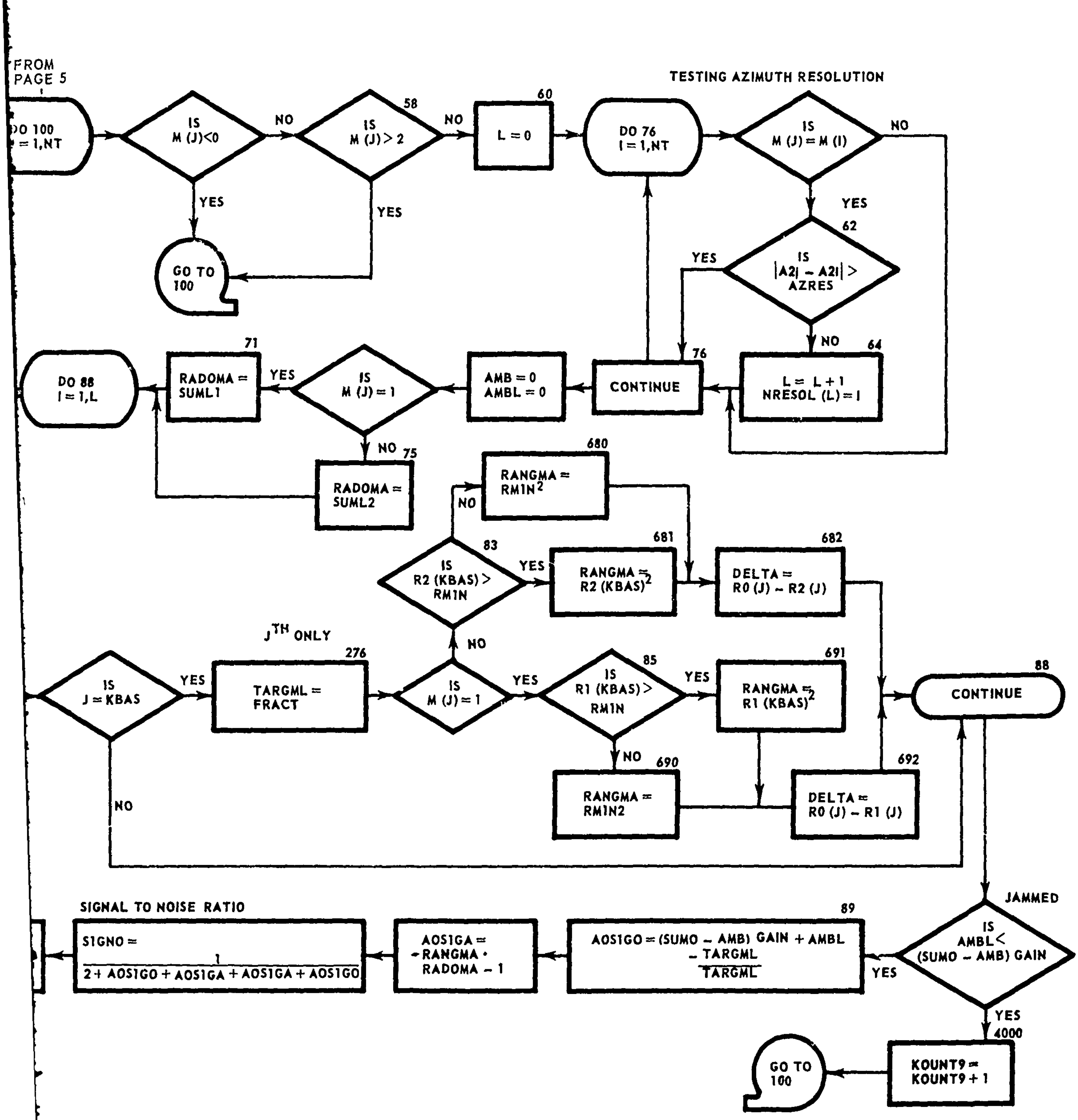
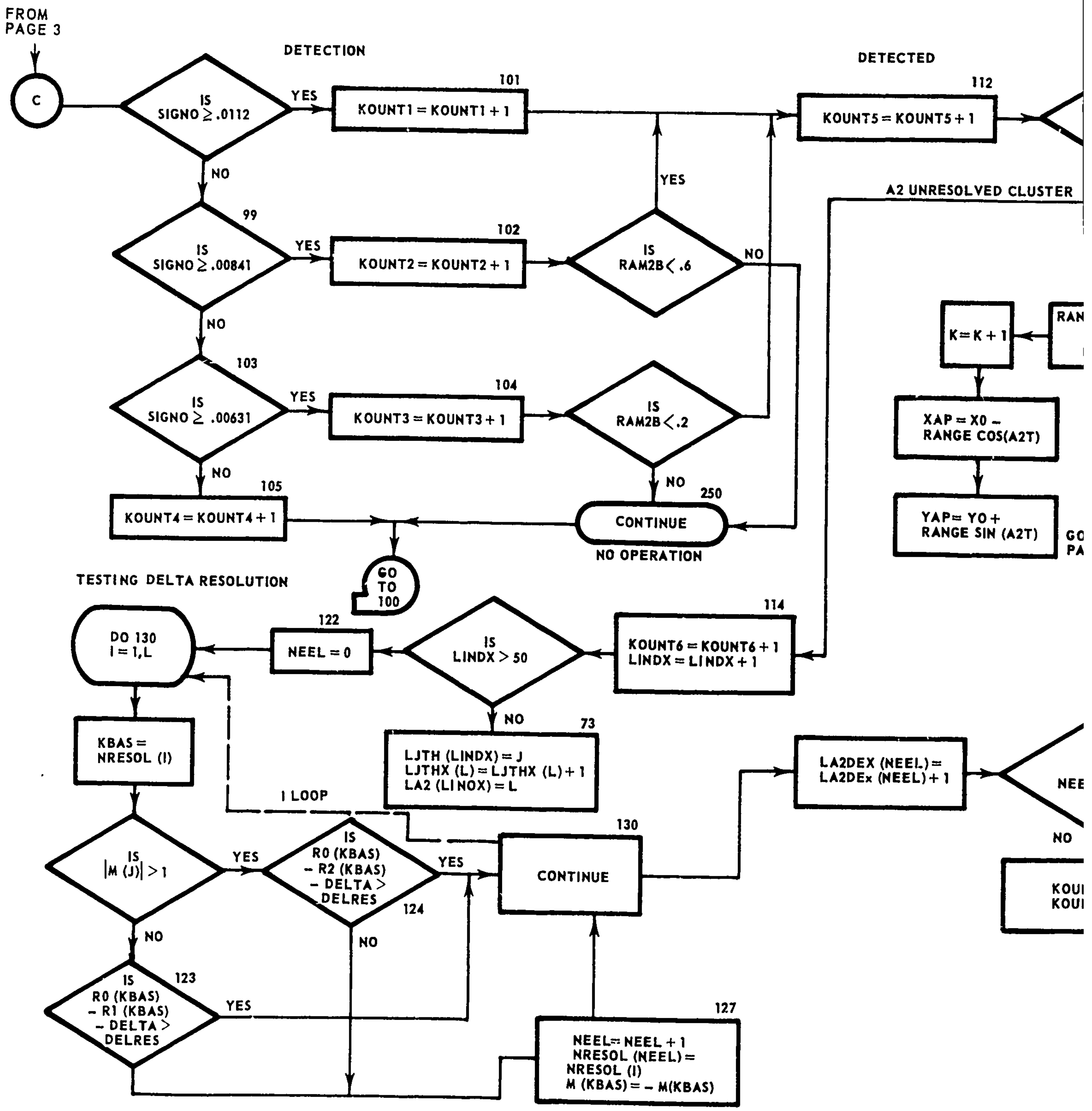


Figure 2-4 (Cont.)

B.


FROM PAGE 3
C
DETECTION
IS SIGNO ≥ .0112
YES
101
KOUNT1 = KOUNT1 + 1
NO
99
IS SIGNO ≥ .00841
YES
102
KOUNT2 = KOUNT2 + 1
IS RAM2B < .6
YES
NO
NO
103
IS SIGNO ≥ .00631
YES
104
KOUNT3 = KOUNT3 + 1
IS RAM2B < .2
NO
NO
105
KOUNT4 = KOUNT4 + 1
250
CONTINUE
NO OPERATION
GO TO 100
DETECTED
112
KOUNT5 = KOUNT5 + 1
A2 UNRESOLVED CLUSTER
K = K + 1
RAN
XAP = X0 - RANGE COS(A2T)
YAP = Y0 + RANGE SIN (A2T)
GO PA
TESTING DELTA RESOLUTION
DO 130 I = 1,L
122
NEEL = 0
IS LINDX > 50
114
KOUNT6 = KOUNT6 + 1 LINDX = LINDX + 1
NO
73
LJTH (LINDX) = J LJTHX (L) = LJTHX (L) + 1 LA2 (LINOX) = L
KBAS = NRESOL (I)
I LOOP
IS |M (J)| > 1
YES
IS R0 (KBAS) - R2 (KBAS) - DELTA > DELRES
YES
124
NO
130
CONTINUE
LA2DEX (NEEL) = LA2DEx (NEEL) + 1
NEE
NO
KOU KOU
NO
123
IS R0 (KBAS) - R1 (KBAS) - DELTA > DELRES
YES
127
NEEL = NEEL + 1 NRESOL (NEEL) = NRESOL (I) M (KBAS) = - M(KBAS)

A,

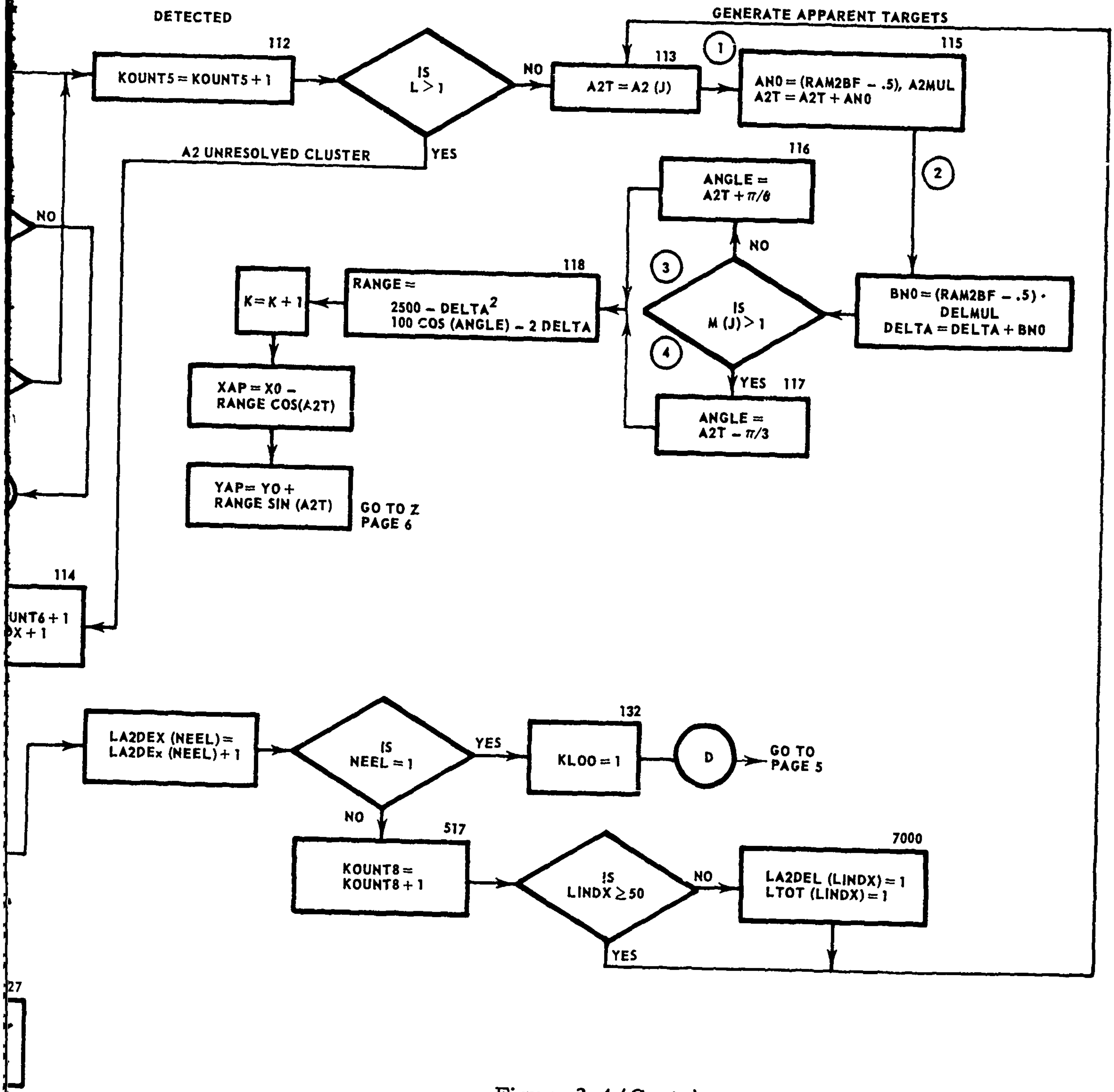
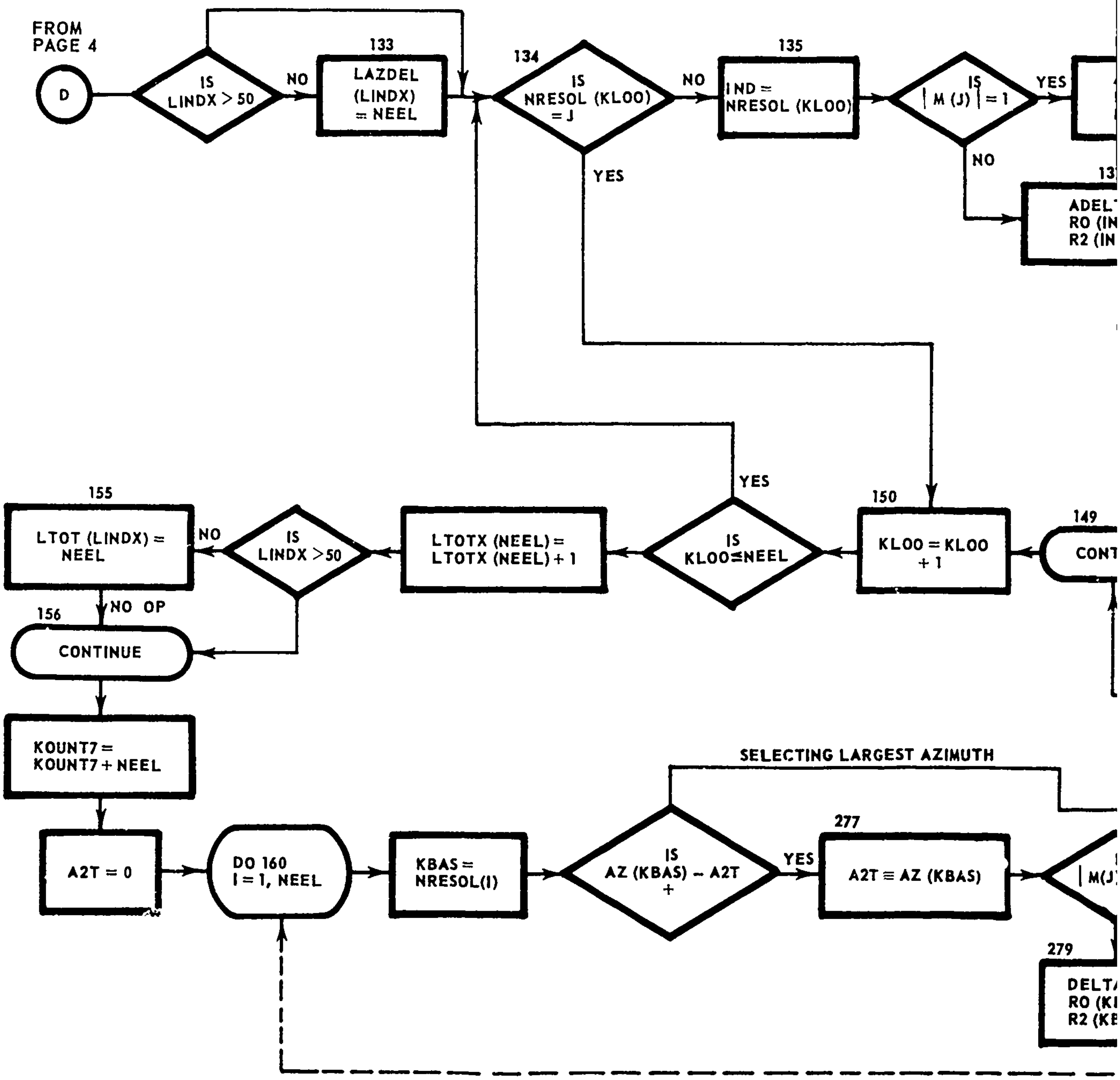


Figure 2-4 (Cont.)


FROM PAGE 4
D
IS LINDX > 50
NO
133
LAZDEL (LINDX) = NEEL
134
IS NRESOL (KLOO) = J
NO
YES
135
IND = NRESOL (KLOO)
IS |M (J)| = 1
YES
NO
13
ADEL
RO (IN
R2 (IN
YES
150
KLOO = KLOO + 1
149
CONT
IS KLOO≤NEEL
LTOTX (NEEL) = LTOTX (NEEL) + 1
IS LINDX >50
NO
155
LTOT (LINDX) = NEEL
156
NO OP
CONTINUE
KOUNT7 = KOUNT7 + NEEL
A2T = 0
DO 160 I = 1, NEEL
KBAS = NRESOL(I)
SELECTING LARGEST AZIMUTH
IS AZ (KBAS) – A2T +
YES
277
A2T ≡ AZ (KBAS)
|M(J
279
DELT
RO (K
R2 (KE

Figu

A,

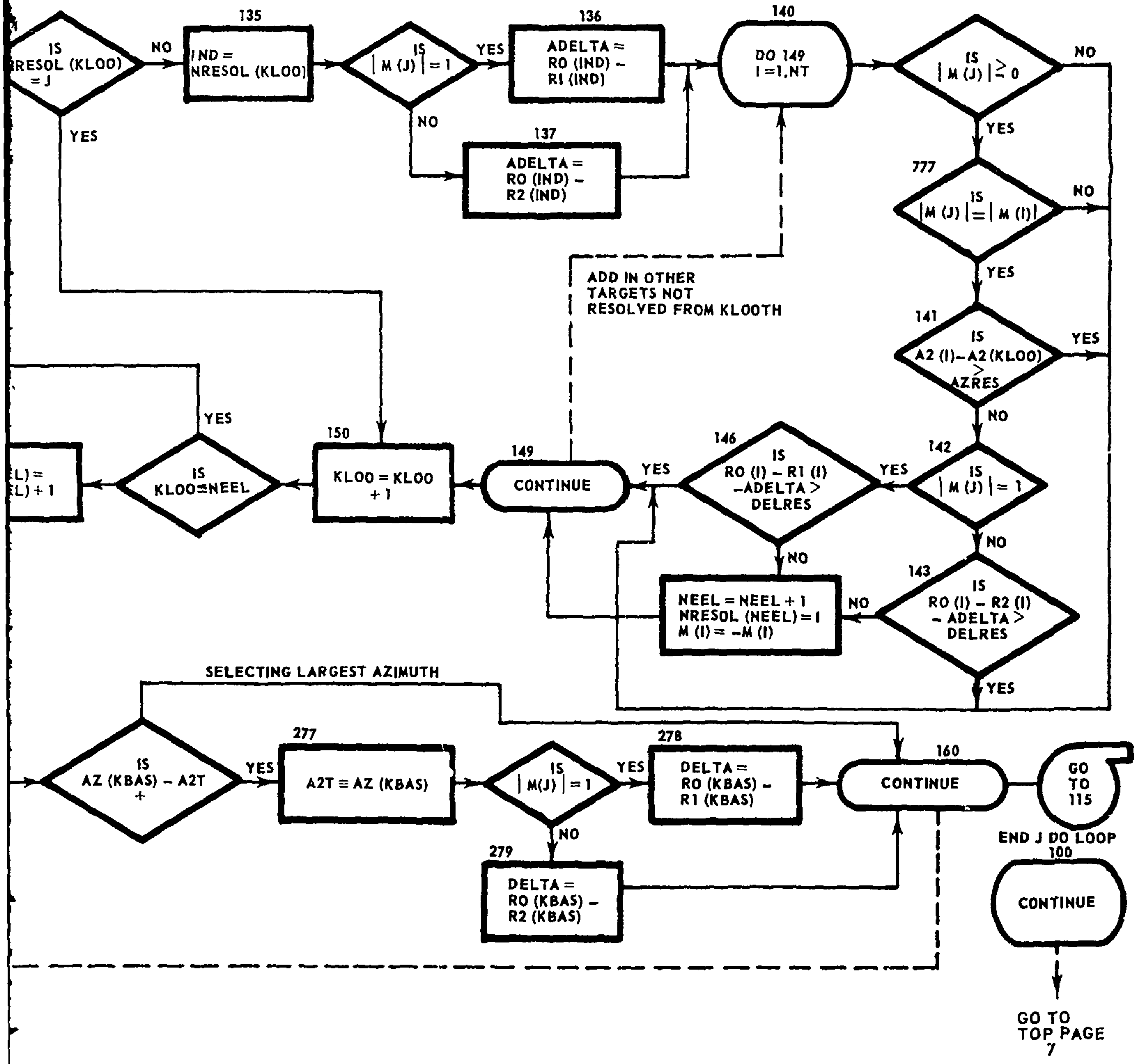


Figure 2-4 (Cont.)

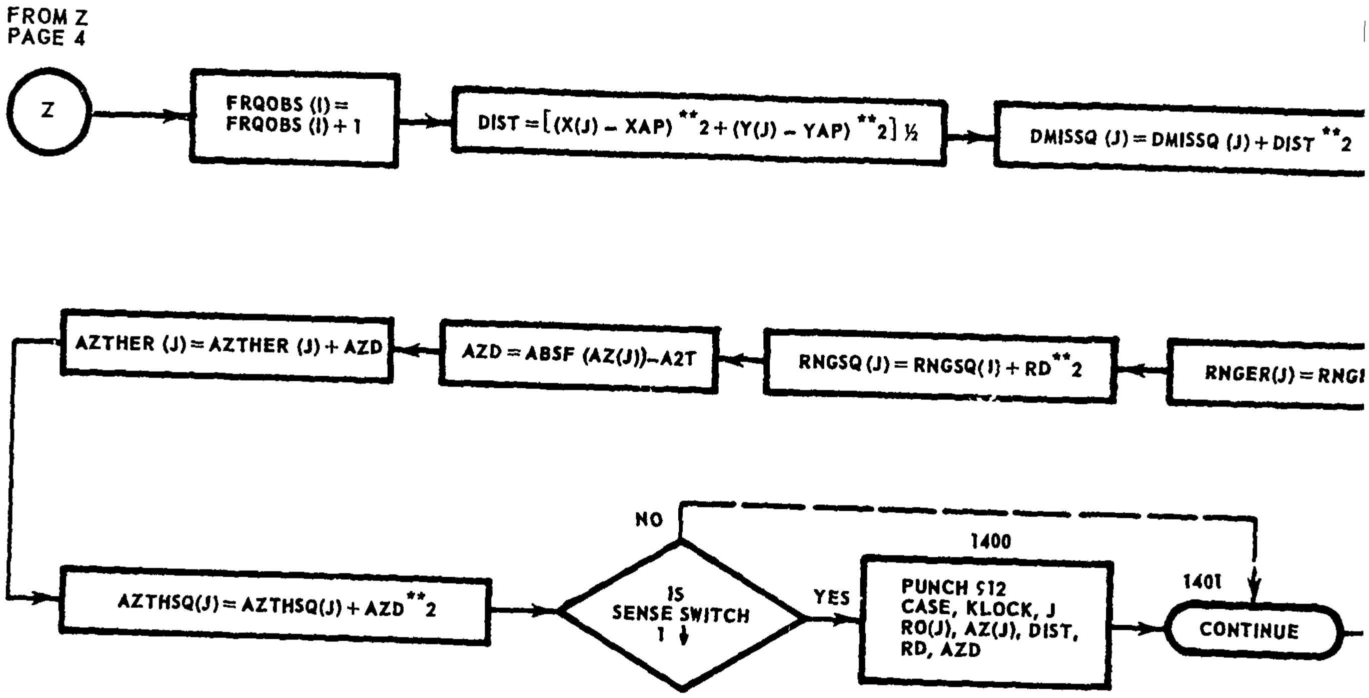

FROM Z
PAGE 4
Z
FRQOBS (I) =
FRQOBS (I) + 1
DIST = [(X(J) – XAP) **2 + (Y(J) – YAP) **2] ½
DMISSQ (J) = DMISSQ (J) + DIST **2
RNGER(J) = RNGI
RNGSQ (J) = RNGSQ(I) + RD**2
AZD = ABSF (AZ(J))–A2T
AZTHER (J) = AZTHER (J) + AZD
AZTHSQ(J) = AZTHSQ(J) + AZD**2
IS
SENSE SWITCH
1 ↓
NO
YES
1400
PUNCH 512
CASE, KLOCK, J
RO(J), AZ(J), DIST,
RD, AZD
1401
CONTINUE

Figure 2-4 (Co

A1

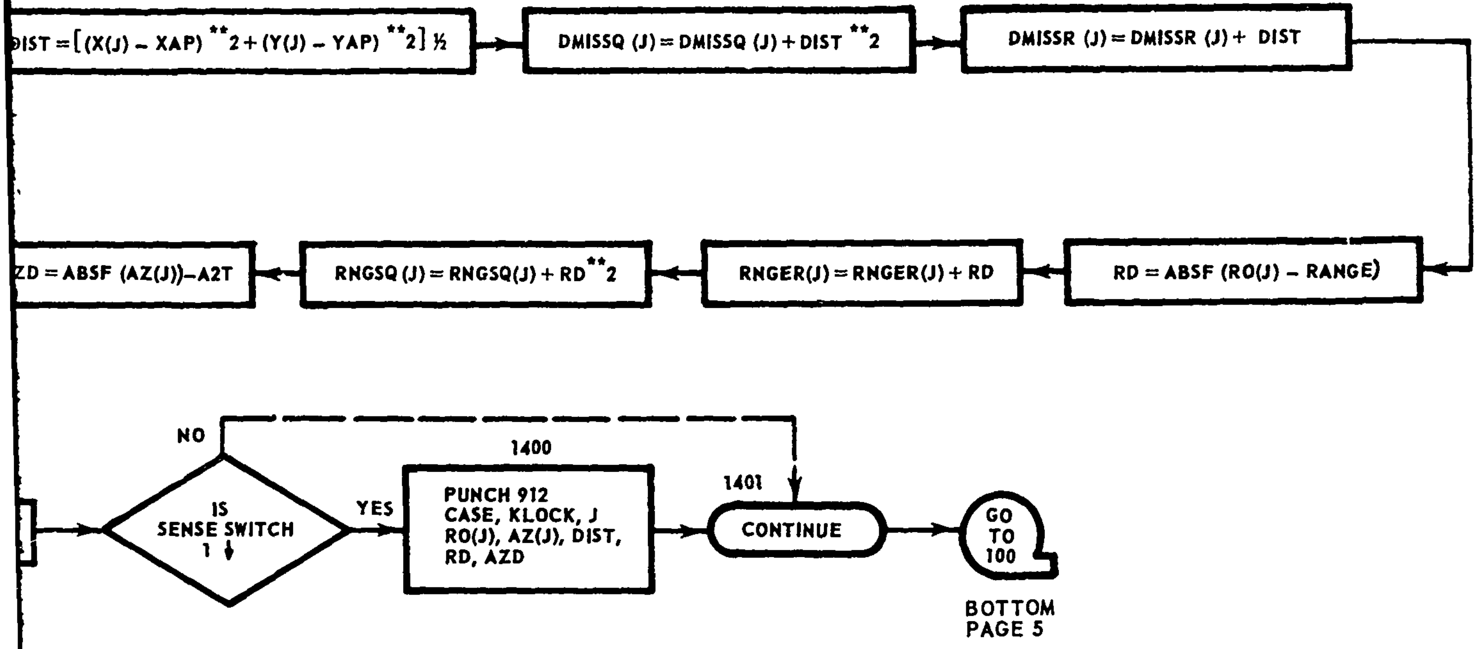
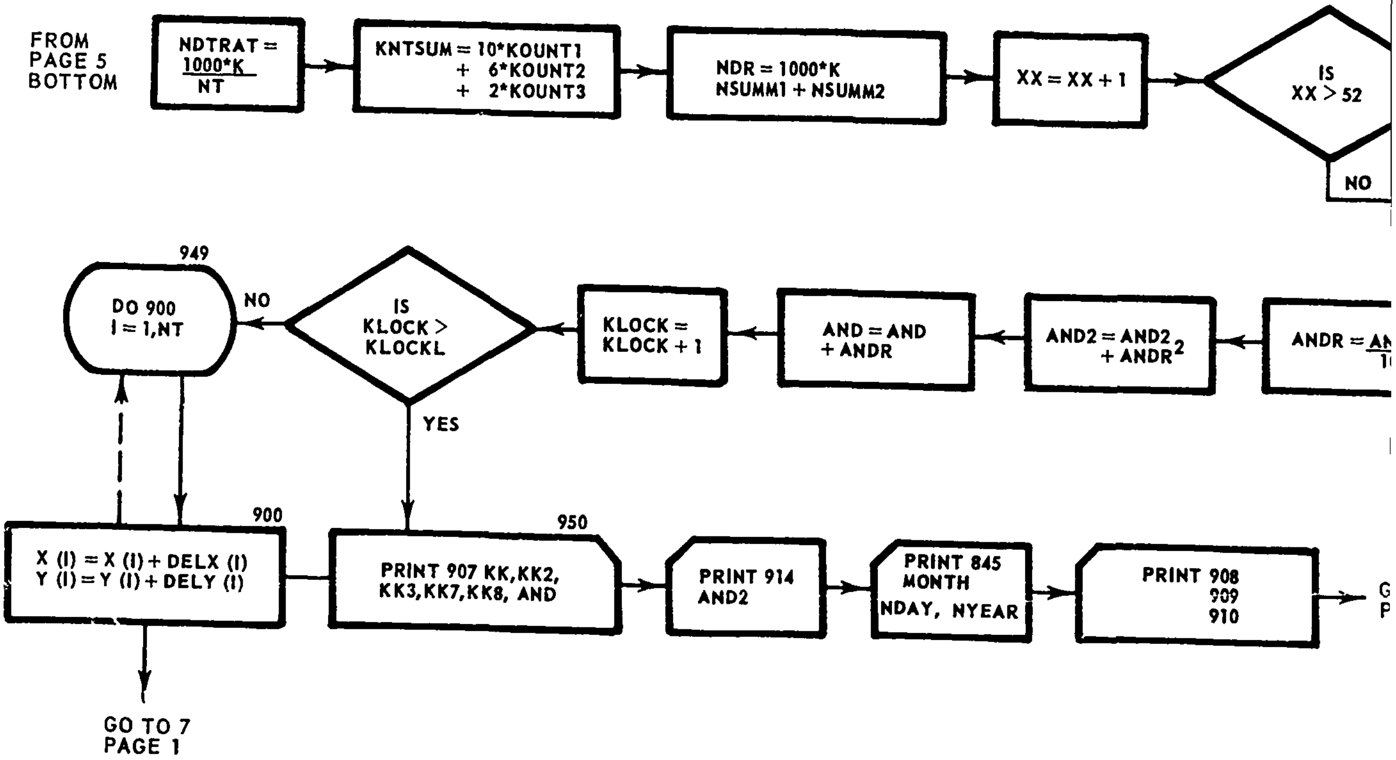

DIST = [(X(J) – XAP) **2 + (Y(J) – YAP) **2] ½
DMISSQ (J) = DMISSQ (J) + DIST **2
DMISSR (J) = DMISSR (J) + DIST
RD = ABSF (RO(J) – RANGE)
RNGER(J) = RNGER(J) + RD
RNGSQ (J) = RNGSQ(J) + RD **2
ZD = ABSF (AZ(J))–A2T
NO
IS SENSE SWITCH 1 ↓
YES
1400
PUNCH 912 CASE, KLOCK, J RO(J), AZ(J), DIST, RD, AZD
1401
CONTINUE
GO TO 100
BOTTOM PAGE 5

Figure 2-4 (Cont.)

B.


FROM PAGE 5 BOTTOM
NDTRAT = 1000*K / NT
KNTSUM = 10*KOUNT1 + 6*KOUNT2 + 2*KOUNT3
NDR = 1000*K NSUMM1 + NSUMM2
XX = XX + 1
IS XX > 52
NO
949
DO 900 I = 1,NT
NO
IS KLOCK > KLOCKL
KLOCK = KLOCK + 1
AND = AND + ANDR
AND2 = AND2 + ANDR2
ANDR = AN 1
YES
900
X (I) = X (I) + DELX (I)
Y (I) = Y (I) + DELY (I)
950
PRINT 907 KK,KK2, KK3,KK7,KK8, AND
PRINT 914 AND2
PRINT 845 MONTH NDAY, NYEAR
PRINT 908 909 910
G P
GO TO 7 PAGE 1

F

A.

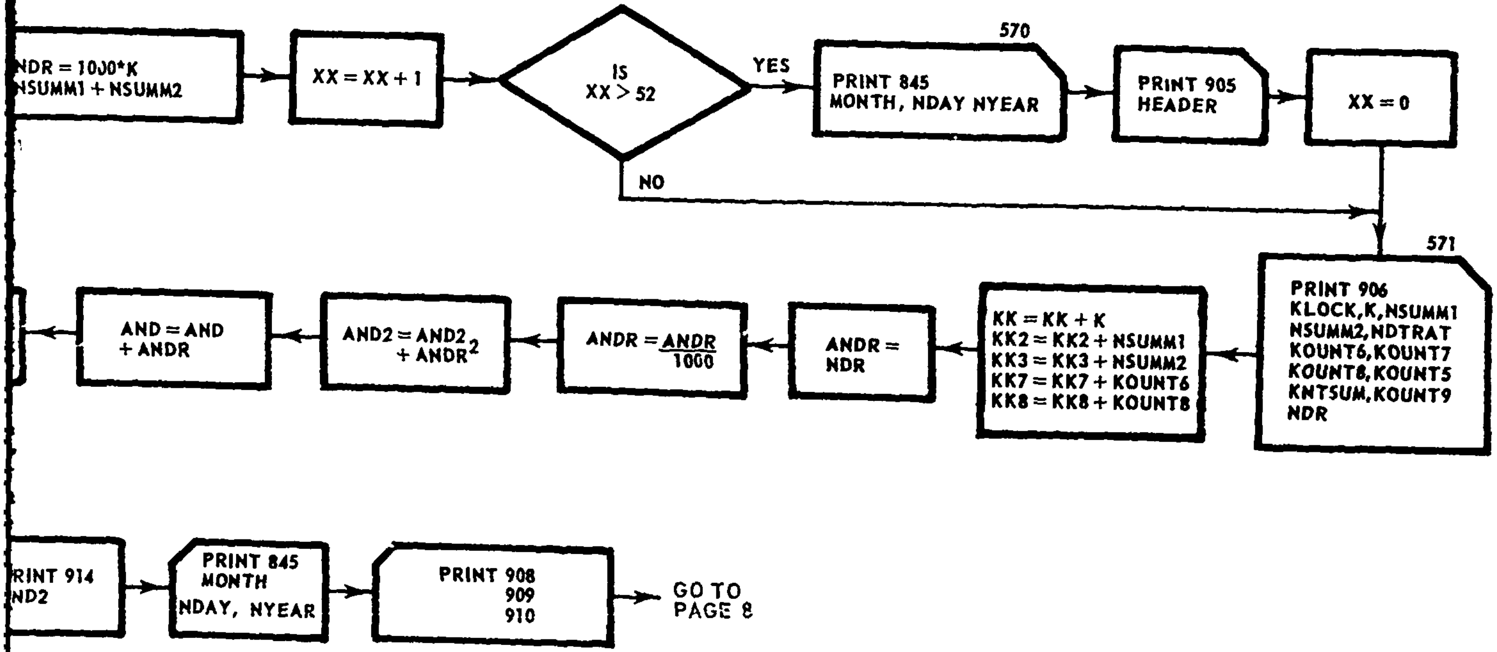


Figure 2-4 (Cont.)

B.

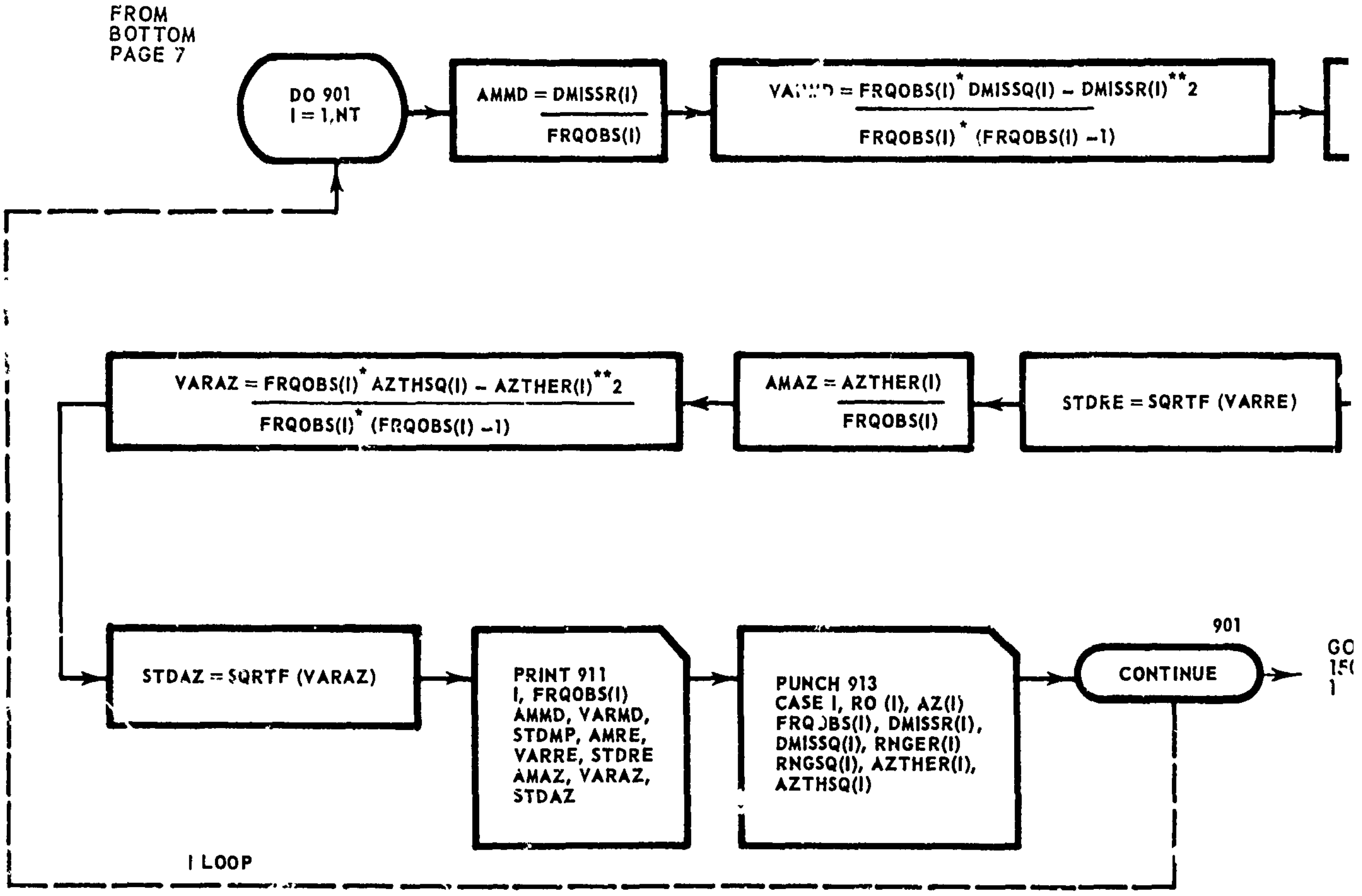

FROM
BOTTOM
PAGE 7
DO 901
I = 1,NT
AMMD = DMISSR(I) / FRQOBS(I)
VARMD = FRQOBS(I)* DMISSQ(I) – DMISSR(I)**2 / FRQOBS(I)* (FRQOBS(I) –1)
VARAZ = FRQOBS(I)* AZTHSQ(I) – AZTHER(I)**2 / FRQOBS(I)* (FRQOBS(I) –1)
AMAZ = AZTHER(I) / FRQOBS(I)
STDRE = SQRTF (VARRE)
STDAZ = SQRTF (VARAZ)
PRINT 911
I, FRQOBS(I)
AMMD, VARMD,
STDMP, AMRE,
VARRE, STDRE
AMAZ, VARAZ,
STDAZ
PUNCH 913
CASE I, RO (I), AZ(I)
FRQOBS(I), DMISSR(I),
DMISSQ(I), RNGER(I)
RNGSQ(I), AZTHER(I),
AZTHSQ(I)
901
CONTINUE
GO
15(
1
I LOOP

Figure 2-4 (

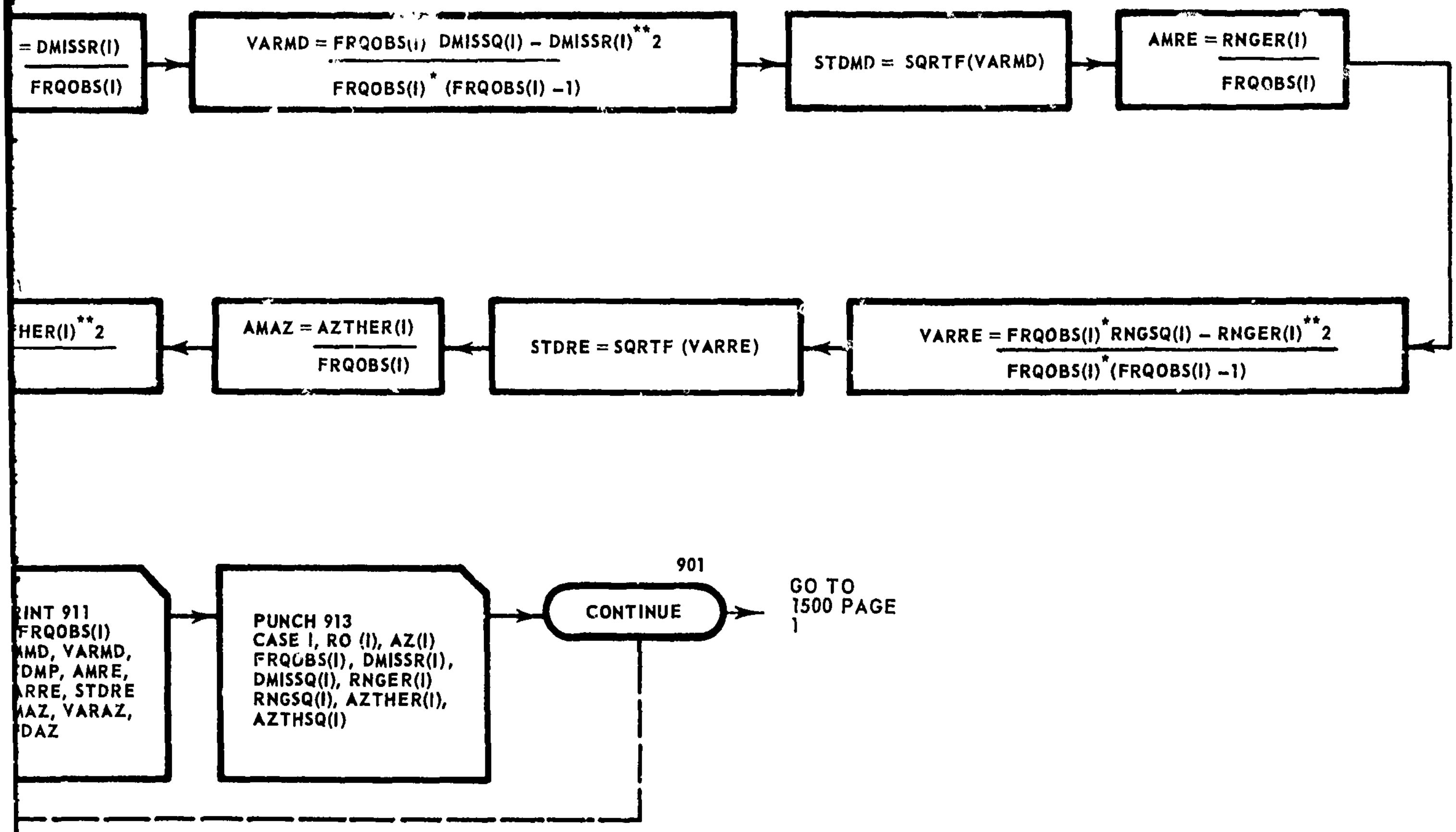


Figure 2-4 (Cont.)

B.

2.5 RAID SIZE ESTIMATION PROGRAM

The Raid Size Estimation Program is a modification to the orignal simulation program to include a process for more realistically estimating the number of targets in the unresolved (AZIMUTH and DELTA) clusters.

The addition of the counter, NESDT (which is used to count the new estimated number of detections), is the principal facility of the "Estimation Program." Originally, when a cluster of targets that were unresolved with respect to the radar was encountered, the scoring section reported only one target detected, regardless of the actual number in the cluster. Since the width of the unresolved cluster is almost always dependent upon the azimuths of the respective members of the cluster, one can give a minimum estimation of the number contained in the cluster. For example; if a cluster extends a width of 30°, and the aximuth resolution of the radar (AZRES) is 3°, it appears evident that there are 30°/3° or 10 radar beam widths in the clustered sector.

The program examines each target per frame to determine if a cluster is reported. If a target is not contained in a cluster, the detection counter (NESDT) is increased by one. When a cluster is reported the program proceeds to compute the width (SECTWD) of the clustered sector. This is accomplished by examining the respective azimuths of the targets in the sector and determining the largest and smallest azimuth of the group. Once the width has been obtained it is divided by the radar beam size (AZRES) to obtain the number of radar beams contained in the clustered It should be noted that this result ($\frac{\text{SECTWD}}{\text{AZRES}}$) should be increased by one to yield the actual minimum number of targets contained in the cluster. (e.g.: if 10 beam widths are contained in the cluster then at least 11 targets are required to construct this sector width).

After completion of the detection analysis, the new estimated number of detections (NESDT), and the new detection rate (NESTR) are printed in tabular form along with the original output.

An optional punched card output has been added which may be used to obtain detection plots, and perhaps utilized in later analysis. The card format contains the case number (CASE), the number of targets in range (NSUM12), the number of apparent targets (K), the number of detections (KOUNT5), the detection rate (NDR), the new estimated number of detections (NESDT), and the new estimated detection rate (NESTR).

The Historical Output Tape 4 has been modified to include, in addition to the coordinates of the true and apparent targets (X, Y, XAP, YAP), the sector width (SECTWD), the range (RANGE), and the azimuth (A2T1) of the true target.

The sum and the sum of squares of the tabular columns of NESTR are also computed and printed at the end of the tabular output.

2.5.1 Glossary

ARANGE	Target range (same as RANGE)
A2T1	Azimuth of the apparent target (same as A2T)
CON1	The angle from Omni 1 to the horizontal, with the main radar as vertex
CON2	The angle from Omni 2 to the horizontal, with the main radar as vertex
FFF1	Sum of the variable NESTR over all of the frames examined
FFF2	Sum of the squares of the variable NESTR over all of the frames examined
FFF3	Same as NESTR
NESDT	Counter containing the new number of detections per frame
NESTR	New rate of detection
NSUM12	Sum of NSUMM1 and NSUMM2
NWIDE	The value used to estimate the minimum number of targets in an unresolved (AZIMUTH and DELTA) cluster
SCTWD1	Same as SECTWD

SECTWD — The sector width of the AZIMUTH and DELTA unresolved cluster, plus the value AZRES

SMALL — The smallest azimuth contained in the unresolved (AZIMUTH and DELTA) cluster

XLARG — The largest azimuth value contained in the unresolved (AZIMUTH and DELTA) cluster

2.5.2 FORTRAN Listing

```
      DIMENSION LJTHX(50),LTOTX(50),LAZDEX(50),NSIGNU(153)
      DIMENSION NTTOAA( 60),DISTT( 60),NMST( 60),NMSA( 60),DISMS( 60),
     1NHTT( 60),NHTA( 60),DISHT( 60),NFST( 60),NFSA( 60),DISFS( 60)
      DIMENSION DIST(31),DISH(31)
      DIMENSION DIFX( 60),DIFY( 60)
      DIMENSION X( 60),Y( 60),RMIN( 60),RMIN2( 60),RMAX( 60),M( 60),
     1RO( 60),R1( 60),R2( 60),AZ( 60)
      DIMENSION NRESOL( 60),LJTH(50),LAZ(50),XAP( 60),YAP( 60),LAZDEL(50
     1),LTOT(50),SCTWD1( 60),AZT1( 60),ARANGE( 60)
      READ 5050,MONTH,NDAY,NYEAR
 5050 FORMAT(3I2)
      READ 222,X1,Y1,X2,Y2,CON1,CON2
 222  FORMAT(6F10.1)
 1500 DO 5335 I=1,50
      LTOTX(I)=0
 5335 LAZDEX(I)=0
      SUX=0.
      SUM=0.
      FRE1=0.
      FRE2=0.
      FRED=0.
      FREQ=0.
      FRED2=0.
      FREQ2=0.
      DXH=0.
      DXM=0.
      NESTR1=0
      NESTR2=0
      PRINT 845,MONTH,NDAY,NYEAR
      DO  6050 I =1,31
      DISH(I)=0.
 6050 DIST(I)=0.
  5002 FORMAT(90H                                                  FLG 5 PROGRAM
     XDATA. BENDIX SYSTEMS DIVISION 704.)
       DO 5334 I=1,50
```

```
5554  LJTMX(I)=0
      DO 8000 I=1,155
8000  NSIGNO(I)=0
      O=0.
      READ 350,K1,K2,K3,K4,K5,K6,K7,K8,K9,K0
350    FORMAT(10I1)
      READ 3,CASE,AZMUL,DELMUL,AZRES,DELRES,GAIN
3     FORMAT(6F10.1)
      REWIND 2
      READ INPUT TAPE 2,1150,NT,NF,ID
1150  FORMAT(3I5)
      DO 1151 I=1,NT
1151  READ INPUT TAPE 2,1152,RMAX(I),RMIN(I),RMIN2(I)
      CLOCKL=NF
      CLOCKS=0.
      XX=CLOCKS
      PRINT 5002




      PRINT 700,CASE,NT
700    FORMAT(12H CASE NUMBERF8.0,4H  NTI4)
      PRINT 1100,CLOCKL,AZMUL,DELMUL,AZRES,DELRES,GAIN
1100  FORMAT((16H           CLOCKLF5.0,6H AZMULF8.6,7H DELMULF8.6,6H AZRE
     1SF8.7,7H DELRESF8.6,5H GAINF8.6)//)
      PRINT 701
  701 FORMAT(116H CLOCK    K NSUMM1 NSUMM2 NSUMM3 NMS NHT NFS NFARAT NHTR
     1AT NMSRAT NDTRAT  K6  K7  K8  K5 KNTSUM  K9  NDR NESTR  NESDT)
400   FORMAT(5F10.2)
1152  FORMAT(3E16.8)
      XO=500.
      YO=500.
      KK=0
      KK1=0
      KK2=0
      KK3=0
      KK4=0
      KK5=0
      KK6=0
      KK7=0
      KK8=0
      AK9=0.
      AK1=0.
      FFF1=0.
      FFF2=0.
599   FORMAT(F6.0)
7     READ INPUT TAPE 2,599,CLOCK
      IF(CLOCK) 301,1177,1177
```

```
1177   DO 1153 I=1,NT
1153    READ INPUT TAPE 2, 1154,X(I),Y(I)
1154   FORMAT(2E16.8)
       KOUNT1=0
       KOUNT2=0
       KOUNT3=0
       KOUNT4=0
       KOUNT5=0
       KOUNT6=0
       KOUNT7=0
       KOUNT8=0
       KOUNT9=0
       NSUMM1=0
       NSUMM2=0
       NSUMM3=0
       SUMLO=0.
       SUMO =0.
       SUML1=0.
       SUML2=0.
       NESDT=0
       NESTR=0
       DO 50 I=1,NT
       DIFX(I)=X(I)-XO
       DIFY(I)=Y(I)-YO
       RO(I)=SQRTF(DIFX(I)**2+DIFY(I)**2)
       IF(RO(I)-RMAX(I)) 9,9,8
9      IF(RO(I)-RMIN(I)) 500,500,501
500    SUMLO=SUMLO+RMIN2(I)
       GO TO 502
501      SUMLO=SUMLO+1./RO(I)**2
502     SUMO=SUMO+1./RO(I)**2
8      R1(I)=SQRTF((X(I)-X1)**2+(Y(I)-Y1)**2)
       IF(R1(I)-RMAX(I)) 11,11,650




11     IF(R1(I)-RMIN(I)) 652,651,651
651    SUML1=SUML1+1./R1(I)**2
       GO TO 650
652     SUML1=SUML1+RMIN2(I)
650    CONTINUE
15     R2(I)=SQRTF((X(I)-X2)**2+(Y(I)-Y2)**2)
       IF(R2(I)-RMAX(I)) 15,15,660
15     IF(R2(I)-RMIN(I)) 662,661,661
661    SUML2=SUML2+1./R2(I)**2
       GO TO 660
662    SUML2=SUML2+RMIN2(I)
660    CONTINUE
```

```
      IF(DIFY(I)) 18,18,19
18    M(I)=3
      NSUMM3=NSUMM3+1
      GO TO 50
19    IF(RO(I)-RMAX(I)) 40,40,22
 40   IF(DIFX(I))20,23,23
20    IF(R1(I)-RMAX(I)) 21,21,22
22    M(I)=4
      GO TO 50
21    M(I)=1
      NSUMM1=NSUMM1+1
      GO TO 26
23    IF(R2(I)-RMAX(I)) 25,25,22
25    M(I)=2
      NSUMM2=NSUMM2+1
26    AZ(I)=ATN1F(DIFY(I),-DIFX(I))
50    CONTINUE
      NSUM12=NSUMM1+NSUMM2
      DO 56 I=1,50
      LJTH(I)=0
      LAZ(I)=0
      LAZDEL(I)=0
56    LTOT(I)=0
      K=0
      LINDX=0
      DO 100 J=1,NT
      IF(M(J)) 100,58,58
58    IF(XABSF(M(J))-2) 60,60,100
60    L=0
      DO 76 I=1,NT
      IF(XABSF(M(I))-XABSF(M(J))) 76,62,76
  62  IF((ABSF(AZ(J)-AZ(I)))-AZRES) 64,64,76
64    L=L+1
      NRESOL(L)=I
76    CONTINUE
72    SIDLO=SUMO
      AMD=0.
      AMDL=0.
74    IF(XABSF(M(J))-1) 75,71,75
75    RADOMA=SUML2
      GO TO 77
71    RADOMA=SUML1
77    DO 80 I=1,L
      KBAS=NRESOL(I)
      FRACT=1./RO(KBAS)**2
      FLJ=1.-ABSF((AZ(J)-AZ(KBAS))/AZRES)
      AMD=AMD+FLJ*FRACT
      IF(FRACT-RMIN2(KBAS)) 275,275,274
274   FRACT=RMIN2(KBAS)
```

```
275    AMBL=AMBL+FLJ*FRACT
       IF(J-KBAS) 88,276,88
276    TARGML=FRACT
       IF(XABSF(M(J))-1) 83,85,83
83     IF(R2(KBAS)-RMIN(KBAS)) 680,680,681
680    RANGMA=RMIN(KBAS)**2
       GO TO 682
681    RANGMA=R2(KBAS)**2
 682   CONTINUE
       DELTA=RO(J)-R2(J)
       GO TO 88
85     IF(R1(KBAS)-RMIN(KBAS)) 690,690,691
690    RANGMA=RMIN(KBAS)**2
       GO TO 692
691    RANGMA=R1(KBAS)**2
692    CONTINUE
       DELTA=RO(J)-R1(J)
88     CONTINUE
       IF(AMBL-(SUMO-AMB)*GAIN)4000,89,89
4000    KOUNT9=KOUNT9+1
       GO TO 100
89     AOSIGO=((SUMO-AMB)*GAIN+AMBL-TARGML)/TARGML
       AOSIGA=(RANGMA*RADOMA)-1.
       SIGNO=1./(2.+AOSIGO+AOSIGA+AOSIGO*AOSIGA)
       NS=SIGNO*500.
       NS=NS+1
       IF(NS-152) 8002,8002,8001
8001   NSIGNO(152)=NSIGNO(152)+1
       GO TO 8003
8002   NSIGNO(NS)=NSIGNO(NS)+1
8003    CONTINUE
       IF(SIGNO-.0112) 99,101,101
101    KOUNT1=KOUNT1+1
       GO TO 112
99     IF(SIGNO-.00041) 103,102,102
102    KOUNT2=KOUNT2+1
       IF(RAM2D (0)-.6) 112,250,250
103    IF(SIGNO-.00031) 105,104,104
104     KOUNT3=KOUNT3+1
       IF(RAM2D (0)-.2) 112,250,250
105     KOUNT4=KOUNT4+1
250    CONTINUE
       GO TO 100
112    KOUNT5=KOUNT5+1
       IF(L-1) 113,113,114
114    KOUNT6=KOUNT6+1
```

```
      LINDX=LINDX+1
      IF(LINDX-50) 73,73,122
73    LJTH(LINDX) =J
      LJTHX(L)=LJTHX(L)+1
      LAZ(LINDX) =L
      GO TO 122
113   AZT=AZ (J)
      SECTWD=AZRES
      NWIDE=1
115   ANO=(RAN2BF(J)-.5)*AZMUL
      NESOT=NESOT+NWIDE
      IF(SENSE SWITCH2)1719,1720
 1719 WRITE OUTPUT TAPE 3,1714,J,SECTWD,NWIDE,XLARG ,SMALL
 1714 FORMAT(12H TARGET NO.=I5,8H SECTWD=F10.4,7H NWIDE=I5,8H XLARGE=F10
     X.3, 7H SMALL=F10.3)




 1720 AZT=AZT+ANO
      BNO=(RAM2BF(J)-.5)*DELMUL
      DELTA=DELTA+ BNO
      IF(XABSF(M(J))-1) 116,116,117
116   ANGLE=AZT+CON1
      GO TO 118
117   ANGLE=AZT-CON2
118   RANGE=(2500.-DELTA**2)/(100.*COSF(ANGLE)-2.*DELTA)
1296  CONTINUE
      K=K+1
120    XAP(K)=XO-RANGE*COSF(AZT)
121   YAP(K)=YO+RANGE*SINF(AZT)
      AZT1(K)=AZT
      SCTWD1(K)=SECTWD
      ARANGE(K)=RANGE
      GO TO 100
122   NEEL=0
      DO 130 I=1,L
      KBAS=NRESOL(I)
      IF(XABSF(M(J))-1)  123,123,124
124   IF(ABSF(RO(KBAS)-R2(KBAS)-DELTA)-DELRES) 127,127,130
123   IF(ABSF(RO(KBAS)-R1(KBAS)-DELTA)-DELRES) 127,127,130
127   NEEL-NEEL+1
      M(KBAS)=-M(KBAS)
      NRESOL(NEEL)=NRESOL(I)
130   CONTINUE
      LAZDEX(NEEL)=LAZDEX(NEEL)+1
      IF(NEEL-1) 517,517,132
517   KOUNT6=KOUNT6+1
      IF(LINDX-50)7000,7000,113
 7000  LAZDEL(LINDX)=1
       LTOT(LINDX)=1
       GO TO 113
  132  KLOO=1
       IF(LINDX-50)133,133,134
  133  LAZDEL(LINDX)=NEEL
  134  IF(NRESOL(KLOO)-J) 135,150,135
  135  IND=NRESOL(KLOO)
       IF(XABSF(M(J))-1) 136,136,137
  136  ADELTA=RO(IND)-R1(IND)
       GO TO 140
  137  ADELTA=RO(IND)-R2(IND)
  140  DO 149 I=1,NT
       IF(M(I)) 149,777,777
  777  IF(XABSF(M(I))-XABSF(M(J)))149,141,149
  141   IF(ABSF(AZ(I)-AZ(KLOO))-AZRES) 142,142,149
  142  IF(XABSF(M(J))-1) 146,146,143
  146  IF(ABSF(RO(I)-R1(I)-ADELTA)-DELRES) 144,144,149
  144   NEEL=NEEL+1
       NRESOL(NEEL)=I
       M(I)=-M(I)
       GO TO 149
  143  IF(ABSF(RO(I)-R2(I)-ADELTA)-DELRES) 144,144,149
  149  CONTINUE
  150  KLOO=KLOO+1
       IF(KLOO-NEEL) 134,134,152
  152  LTOTX(NEEL)=LTOTX(NEEL)+1
       IF(LINDX-50)155,155,156
  155  LTOT(LINDX)=NEEL
  156  SUMAZ=0.
       DENOM=NEEL




       KOUNT7=KOUNT7+NEEL
       AZT=0.
       IF(SENSE SWITCH2)1715,1716
  1715 WRITE OUTPUT TAPE 5,1713
  1713 FORMAT(41H     J  AZIMUTH    NO. OF UNRESOLVED TARGET)
  1716 DO 160 I=1,NEEL
       KBAS=NRESOL(I)
       IF(SENSE SWITCH2)1717,1718
  1717 WRITE OUTPUT TAPE 5,1712,J,AZ(KBAS),NRESOL(I)
  1712 FORMAT(I5,F10.3,I24)
  1718 IF(AZ(KBAS)-AZT)160,160,277
 277   AZT=AZ(KBAS)
       IF(XABSF(M(J))-1)278,278,279
 278   DELTA=RO(KBAS)-R1(KBAS)
       GO TO 160
```

```
275     DELTA=RO(KBAS)-RZ(KBAS)
180     CONTINUE
        KBAS=NRESUL(1)
        XLARG=AZ(KBAS)
        SMALL=AZ(KBAS)
        DO 1710 I=2,NCEL
        KBAS =NRESUL(I)
        IF(AZ(KBAS)-SMALL)1703,1704,1704
 1704   IF(XLARG-AZ(KBAS))1705,1710,1710
 1705   XLARG=AZ(KBAS)
        GO TO 1710
 1703   SMALL=AZ(KBAS)
 1710   CONTINUE
        SECTWD=XLARG-SMALL+AZRES
        NWIDE =SECTWD/AZRES+.5
        GO TO 115
155     CONTINUE
        NMS=0
        NMT=0
        NPS=0
        IF(K)570,571,570
571      DO 572 ITR=1,NT
        NMS=NMS+1
        NMST(NMS)=ITR
         NMSA(NMS)=-0
572     DISMS(NMS)=-0
        GO TO 575
570      DO 166 ITR=1,NT
        IAP=1
         NTTOAA(ITR) =1
        XTRO=X(ITR)
        YTRO=Y(ITR)
        DIFRX=ABS (XTRO-XAP(IAP))
        DIFRY=ABS (YTRO-YAP(IAP))
        DISSQ=DIFRY**2+DIFRX**2
        DO 166 IAP=2,K
        TDIFRX=ABSF(XTRO-XAP(IAP))
        TDIFRY=ABSF(YTRO-YAP(IAP))
         IF(TDIFRX-DIFRX) 165,164,164
164     IF(TDIFRY-DIFRY)165,166,166
165      TDISSQ=TDIFRX**2+TDIFRY**2
        IF(TDISSQ-DISSQ) 167,166,166
167     NTTOAA(ITR)=IAP
        DISSQ=TDISSQ
        DIFRX=TDIFRX
        DIFRY=TDIFRY
```

```
166    CONTINUE
168    DISTT(ITR)=SQRTF(DISSQ)
171    DO 178 IAP=1,K
       ITR=1
       NATOTT=1
       YAPP=YAP(IAP)
       XAPP=XAP(IAP)
       DIFRX=ABSF(X(ITR)-XAPP)
       DIFRY=ABSF(Y(ITR)-YAPP)
       DISSQ=DIFRX**2+DIFRY**2
172     DO 175 ITR=2,NT
       TDIFRX=ABSF(X(ITR)-XAPP)
       TDIFRY=ABSF(Y(ITR)-YAPP)
       IF(TDIFRX-DIFRX) 169,170,170
170      IF(TDIFRY-DIFRY) 169,175,175
169    TDISSQ=TDIFRX**2+TDIFRY**2
       IF(TDISSQ-DISSQ) 173,175,175
173    NATOTT=ITR
       DISSQ=TDISSQ
       DIFRX=TDIFRX
       DIFRY=TDIFRY
175     CONTINUE
          DISTA=SQRTF(DISSQ)
       IF(XABSF(NTTOAA(NATOTT))-IAP) 176,177,176
177    NHT=NHT+1
       NHTT(NHT)=NATOTT
       NHTA(NHT)=IAP
       DISHT(NHT)=DISTT(NATOTT)
       MHD=DISHT(NHT)*4.
       MHD=MHD+1
       IF(MHD-31) 1404,1405,1405
1405   DISH(31)=DISH(31)+1.
       GO TO 1406
1404   DISH(MHD)=DISH(MHD)+1.
1406   CONTINUE
       NTTOAA(NATOTT)=-NTTOAA(NATOTT)
       GO TO 178
176     NFS=NFS+1
       NFST(NFS)=NATOTT
       NFSA(NFS)=IAP
       DISFS(NFS)=SQRTF(DISSQ)
178     CONTINUE
       DO 440 ITR=1,NT
       IF(NTTOAA(ITR)) 440,440,442
442    NMS=NMS+1
       NMST(NMS)=ITR
        NMSA(NMS)=NTTOAA(ITR)
       DISMS(NMS)=DISTT(ITR)
       MDS=DISMS(NMS)/5.
       MDS=MDS+1
       IF(MDS-31) 1400,1401,1401
```

```
1401   DIST(31)=DIST(31)+1.
       GO TO 1402
1400   DIST(MDS)=DIST(MDS)+1.
1402   CONTINUE
440    CONTINUE
575    CONTINUE
       NFARAT=(1000*NFS)/K
       NMSRAT=(1000*NMS)/NT
       NDTRAT=(1000*K)/NT
       NHTRAT=(1000*NHT)/K




       KNTSUM=(10*KOUNT1+6*KOUNT2+2*KOUNT3)
       NDR=(1000*K)/(NSUMM1+NSUMM2)
       NESTR= (1000*NESDT)/NSUM12
       ANDR=NDR
       ANDR=ANDR/1000.
       AND2=ANDR**2
       FFF3=NESTR
       FFF3=FFF3/1000.
       AK1=AK1+AND2
       XX=XX+1.
       IF(XX-(51.+CLOCKS))844,843,844
843    PRINT 845,MONTH,NDAY,NYEAR
       XX=CLOCKS
       PRINT 5002
       PRINT 700,CASE,NT
845    FORMAT(106H1
      1                                                    DATE RUNI3,1H/I2,1H/I
      22)
       PRINT 701
844    CONTINUE
       PRINT 702,CLOCK,K,NSUMM1,NSUMM2,NSUMM3,NMS,NHT,NFS,NFARAT,NHTRAT,
      XNMSRAT,NDTRAT,KOUNT6,KOUNT7,KOUNT8,KOUNT5,KNTSUM,KOUNT9,NDR,NESTR
      X,NESDT
       IF(SENSE SWITCH 1)1707,1708
 1707 PUNCH 1709,CASE,CLOCK,NSUM12,K,KOUNT5,NDR,NESTR,NESDT
 1709 FORMAT(2F6.0,6I6)
 1708 KK=KK+K
       KK2=KK2+NSUMM1
       KK3=KK3+NSUMM2
       KK4=KK4+NMS
       KK5=KK5+NHT
       KK6=KK6+NFS
       KK7=KK7+KOUNT6
       KK8=KK8+KOUNT8
       AK9=AK9+ANDR
```

```
        FFF1=FFF1+FFF3
        FFF2=FFF2+(FFF3)**2
  702   FORMAT(F6.0,2I4,3I7,2I4,I5,3I7,I6,3I4,2I6,3I5)
        IF(K3) 8075,8075,8076
 8076   CONTINUE
        WRITE OUTPUT TAPE 4,900,CASE,CLOCK,NT,K
 900    FORMAT(F11.6,F10.0,2I5)
        DO 901 I=1,NT
 901     WRITE OUTPUT TAPE 4,902,X(I),Y(I)
  902   FORMAT(5F14.4)
        IF(K) 6000,6001,6000
 6000   DO 903 I=1,K
  903   WRITE OUTPUT TAPE 4,902,XAP(I),YAP(I),SCTWD1(I),A2T1(I),ARANGE(I)
 6001   CONTINUE
 8075   CONTINUE
 359    IF(K6) 361,361,362
 362    KEN=6
        IF(NMS) 2100,2200,2100
 2100   DO 906 I=1,NMS
 906     WRITE OUTPUT TAPE 3,907,KEN,CASE,CLOCK,NMST(I),NMSA(I),DISMS(I)
 2200   CONTINUE
 361    IF(K7) 363,363,364
 364    KEN=7
        IF(NHT) 2101,2102,2101
 2101   DO 908 I=1,NHT
        IS=NHTA(I)
        ID=NHTT(I)
 908    WRITE OUTPUT TAPE 3,907,KEN,CASE,CLOCK,NHTT(I),NHTA(I),DISHT(I),
       1X(ID),Y(ID),XAP(IS),YAP(IS)
 2102   CONTINUE
 363     IF(K8) 365,365,366
 366    KEN=8
        IF(NFS) 2103,2104,2103
 2103   DO 909 I=1,NFS
 909    WRITE OUTPUT TAPE 3,907,KEN,CASE,CLOCK,NFST(I),NFSA(I),DISFS(I)
 365     CONTINUE
 2104   CONTINUE
        GO TO 7
 301    KEN=0
        PRINT 5555,KK,KK2,KK3,KK4,KK5,KK6,KK7,KK8
 5555   FORMAT(4H TOT16,I5,I6,I13,2I5,I51,I14)
        PRINT 1711,AK9,AK1,FFF1,FFF2
  1711 FORMAT( 13H SUM OF NDR= F10.4,23H SUM OF SQUARES OF NDR=F12.6,14H
       XSUM OF NESTR=F10.4,25H SUM OF SQUARES OF NESTR=F12.6)
 5551    FORMAT(7H  TOTALI14,I5,I15)
        PRINT 845,MONTH,NDAY,NYEAR
```

```
      PRINT 700,CASE,NT
      PRINT 5002
      PRINT 1666
1666  FORMAT(56H                   HITS                                     MISSES
     1)
      PRINT 1667
1667  FORMAT(70H     LOWER    UPPER   NUMBER   STD FREQ     LOWER UPPER   NUM
     1BER   STD FREQ   )
1408  FORMAT(37H          HITS                         MISSES   )
1409  FORMAT(46H LOWER   UPPER NUMBER         LOWER   UPPER NUMBER
      XLOW=0.
      HIGH=5.
      XLO=0.
      HIG=.25
      DO 1668 I=1,31
      SUX=SUX+DIST(I)
1668  SUM=SUM+DISH(I)
      SUX=1000./SUX
      SUM=1000./SUM
      DO 1411 I=1,31
      LXX=DISH(I)*SUM+.5
      LYY=DIST(I)*SUX+.5
      PRINT 1410,XLO,HIG,DISH(I),LXX,XLOW,HIGH,DIST(I),LYY
      FREQ=(HIG-XLO)/2.+XLO
      FRED=(HIGH-XLOW)/2.+XLOW
      FREQ2=FREQ2+FREQ**2*DISH(I)
      FRED2=FRED2+FRED**2*DIST(I)
      FRE1=FRE1+FREQ*DISH(I)
      FRE2=FRE2+FRED*DIST(I)
      DXH=DXH+DISH(I)
      DXM=DXM+DIST(I)
      XLOW=HIGH
      HIGH=HIGH+5.
      XLO=HIG
1411  HIG=HIG+.25
1410  FORMAT(F10.2,F7.2,F8.0,I10,F10.0,F7.0,F8.0,I10)
      SIGMAH=SQRTF(FREQ2/DXH-(FRE1/DXH)**2)
      SIGMAM=SQRTF(FRED2/DXM-(FRE2/DXM)**2)
      BARH=FRE1/DXH
      BARM=FRE2/DXM
      PRINT 1669,SIGMAH,SIGMAM,BARH,BARM




1669  FORMAT(13H     SIGMA HITF8.3,11H SIGMA MISSF8.3,9H MEAN HITF9.3,10H
     1 MEAN MISSF9.3)
      IF(KO) 369,369,370
370   HIGH=.002-
      PRINT 845,MONTH,NDAY,NYEAR
5000  FORMAT (1H1)
```

```
      PRINT 5002
      PRINT 700,CASE,NT
      PRINT 450
450   FORMAT(48H          FREQUENCY DISTRIBUTION SIGNAL TO NOISE  )
      PRINT 451
451   FORMAT(42H      LIMITS                          LIMITS  )
      PRINT 452
452   FORMAT(86H LOWER    UPPER    NUMBER       LOWER     UPPER     NUMBER
     1       LOWER    UPPER    NUMBER  )
      XLOW=.0
      XLOWR=.102
      XLO=.204
      XHIG=.206
       HIGHR=.104
      DO 453 I=1,51
      PRINT 454,XLOW,HIGH,NSIGNO(I),XLOWR,HIGHR,NSIGNO(I+51),XLO,XHIG,
     1NSIGNO(I+101)
454   FORMAT(F6.3,F9.3,I8,F13.3,F9.3,I8,F13.3,F9.3,I8)
      XLO=XHIG
       XHIG=XHIG+.002
506   FORMAT(F6.1,F9.3,I8,F13.3,F9.3,I8)
      XLOW=HIGH
       HIGH=HIGH+.002
      XLOWR=HIGHR
453   HIGHR=HIGHR+.002
505   CONTINUE
  465 FORMAT(11H DURING THIS RAID,I4,35H AZIMUTH UNRESOLVED SECTORS WERE F
     XOUND WHICH CONTAINED I5,8H TARGETS)
      IF(K1) 460,460,461
461   PRINT 845,MONTH,NDAY,NYEAR
      PRINT 700,CASE,NT
      PRINT 472
      LL1=0
      LL2=0
      LL3=0
       DO 464 I=2,50
      LL1=LL1+LJTHX(I)
      LL2=LL2+LAZDEX(I)
5556  LL3=LL3+LTOTX(I)
464   PRINT 462,I,LJTHX(I),LAZDEX(I),LTOTX(I),I
      PRINT 5557,LL1,LL2,LL3
472   FORMAT(57H  NO TARGETS   AZ UNR   AZ+DEL  AZ+DEL+OTHERS  NO TARGET
     1S )
462   FORMAT(I12,2I9,I15,I9)
460   CONTINUE
      PAUSE 1
      GO TO 1500
507   FORMAT(I5,F10.5,F5.0,2I8,5F8.2)
 904  FORMAT(I5,F10.5,F5.0,5I8)
      END(0,1,0,0,1)
```

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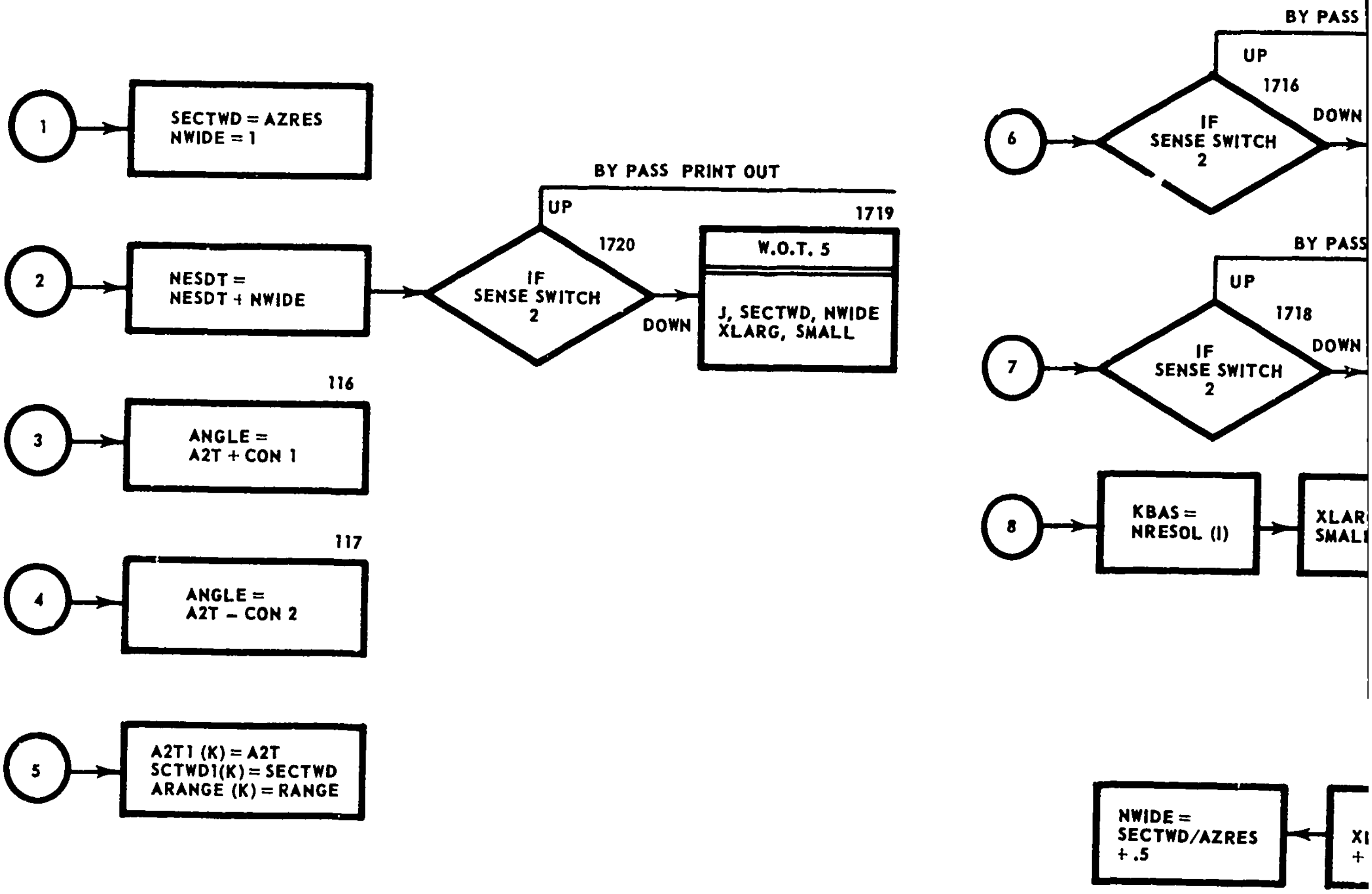


Figure 2-5 M

A1

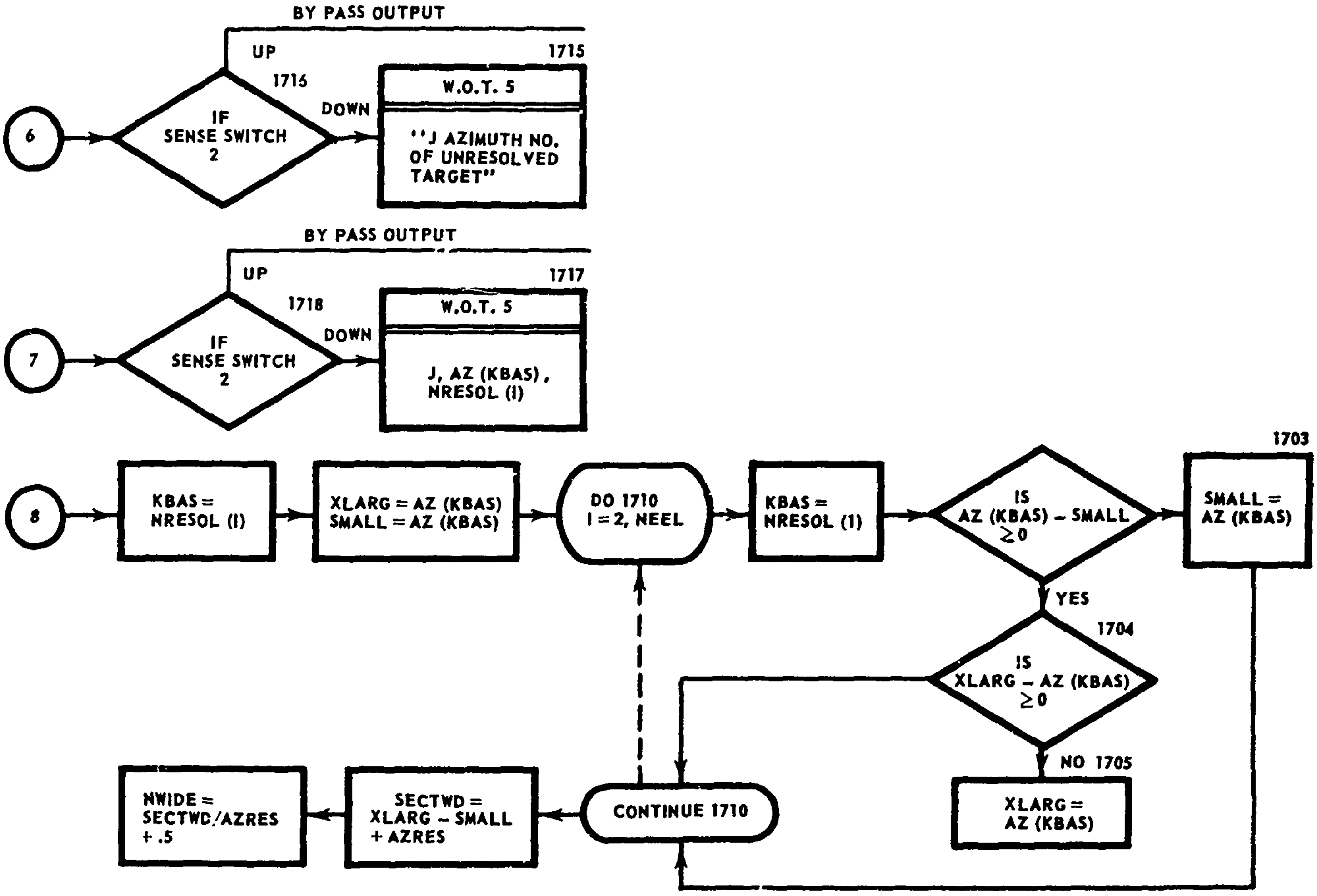
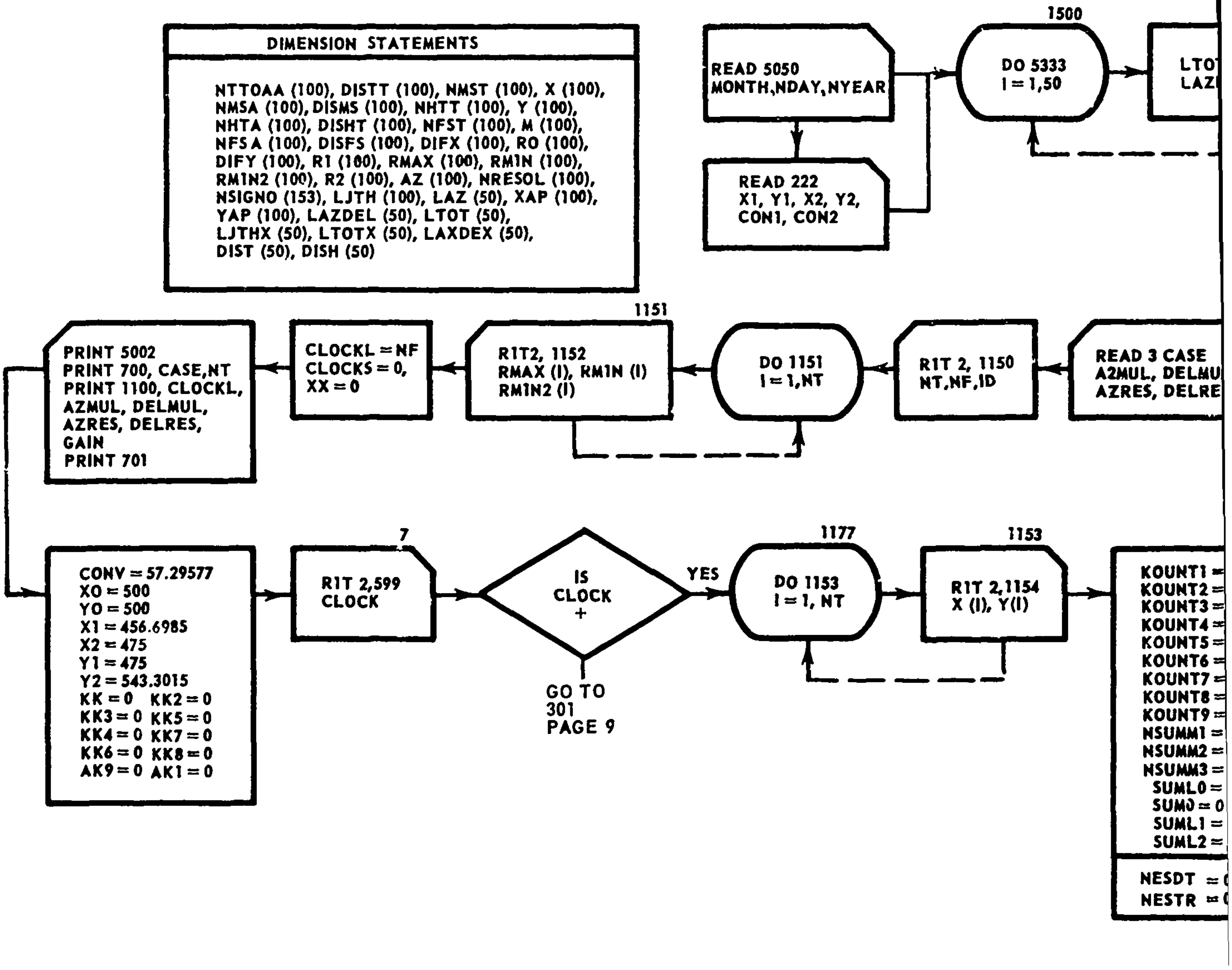


Figure 2-5 Modifications to Basic Program for Raid Size Estimation

B.


DIMENSION STATEMENTS
NTTOAA (100), DISTT (100), NMST (100), X (100), NMSA (100), DISMS (100), NHTT (100), Y (100), NHTA (100), DISHT (100), NFST (100), M (100), NFSA (100), DISFS (100), DIFX (100), RO (100), DIFY (100), R1 (100), RMAX (100), RMIN (100), RMIN2 (100), R2 (100), AZ (100), NRESOL (100), NSIGNO (153), LJTH (100), LAZ (50), XAP (100), YAP (100), LAZDEL (50), LTOT (50), LJTHX (50), LTOTX (50), LAXDEX (50), DIST (50), DISH (50)
READ 5050
MONTH,NDAY,NYEAR
READ 222
X1, Y1, X2, Y2,
CON1, CON2
1500
DO 5333
I = 1,50
LTO
LAZ
1151
PRINT 5002
PRINT 700, CASE,NT
PRINT 1100, CLOCKL,
AZMUL, DELMUL,
AZRES, DELRES,
GAIN
PRINT 701
CLOCKL = NF
CLOCKS = 0,
XX = 0
RIT2, 1152
RMAX (I), RMIN (I)
RMIN2 (I)
DO 1151
I = 1,NT
RIT 2, 1150
NT,NF,ID
READ 3 CASE
AZMUL, DELMU
AZRES, DELRE
7
1177
1153
CONV = 57.29577
XO = 500
YO = 500
X1 = 456.6985
X2 = 475
Y1 = 475
Y2 = 543.3015
KK = 0 KK2 = 0
KK3 = 0 KK5 = 0
KK4 = 0 KK7 = 0
KK6 = 0 KK8 = 0
AK9 = 0 AK1 = 0
RIT 2,599
CLOCK
IS
CLOCK
+
YES
GO TO
301
PAGE 9
DO 1153
I = 1, NT
RIT 2,1154
X (I), Y(I)
KOUNT1 =
KOUNT2 =
KOUNT3 =
KOUNT4 =
KOUNT5 =
KOUNT6 =
KOUNT7 =
KOUNT8 =
KOUNT9 =
NSUMM1 =
NSUMM2 =
NSUMM3 =
SUML0 =
SUM0 = 0
SUML1 =
SUML2 =
NESDT =
NESTR =

Fi

A1

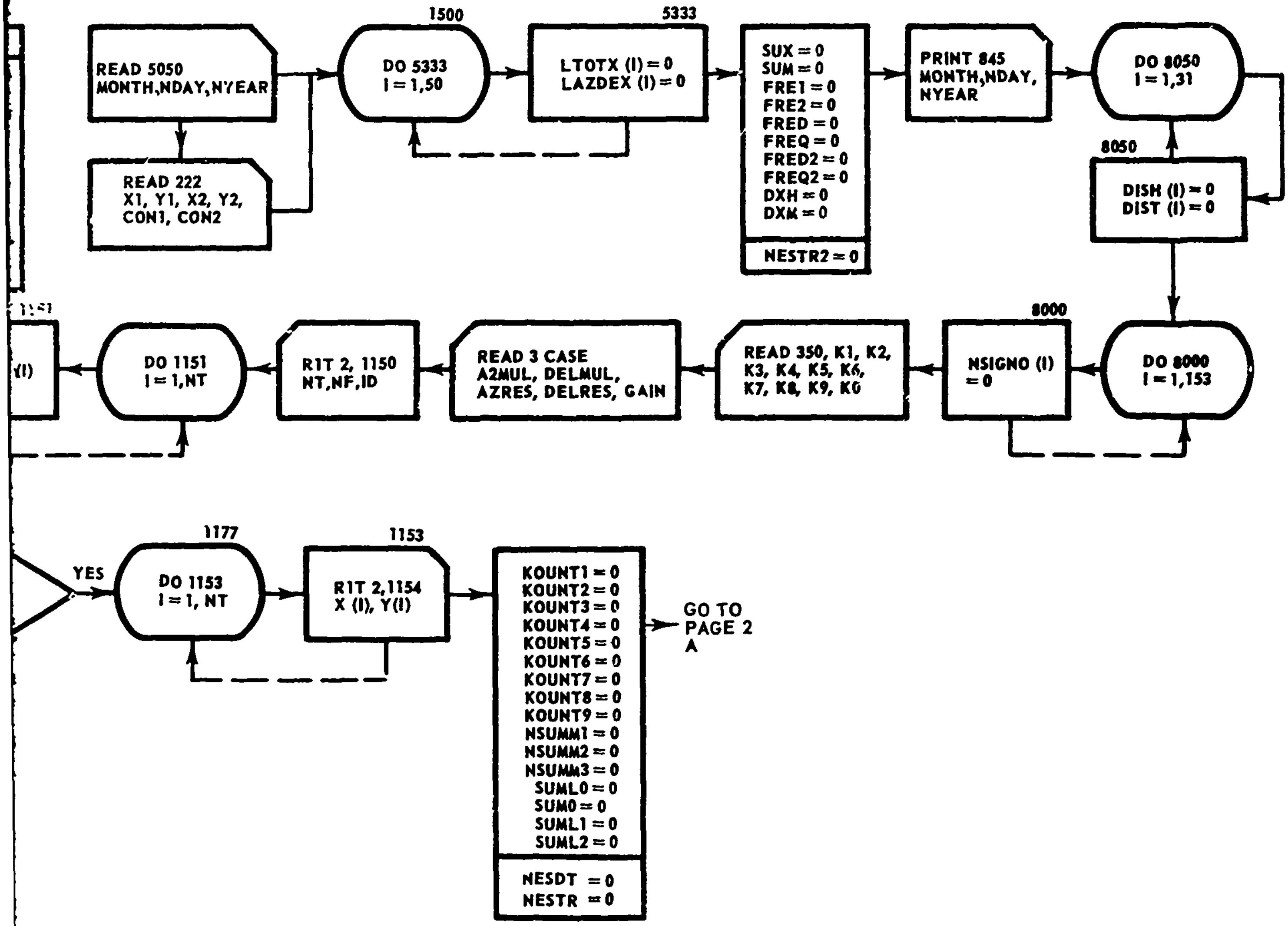
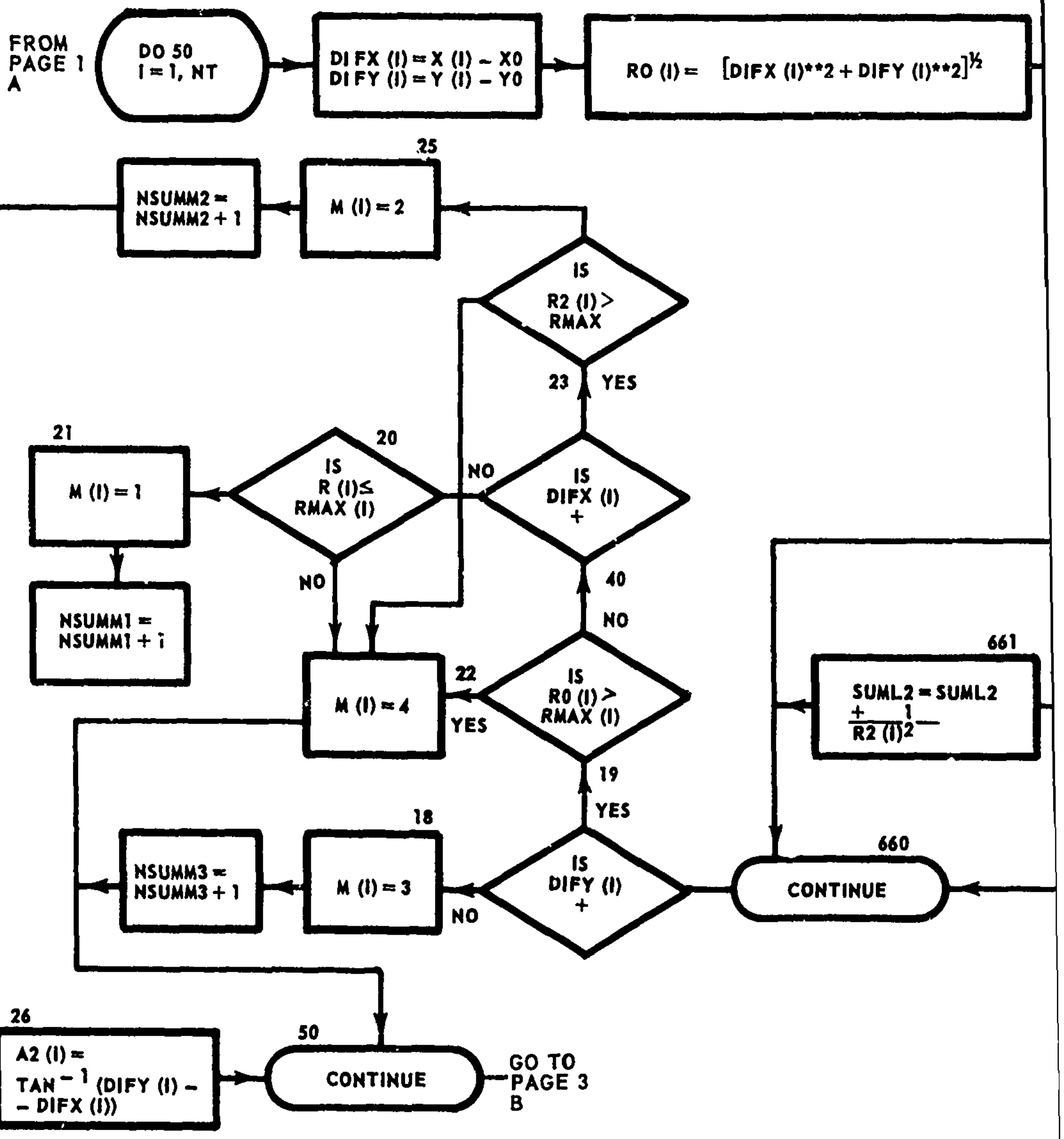


Figure 2-5 (Cont.)

B.


FROM PAGE 1 A
DO 50 I = 1, NT
DIFX (I) = X (I) – X0
DIFY (I) = Y (I) – Y0
R0 (I) = [DIFX (I)**2 + DIFY (I)**2]½
25
NSUMM2 = NSUMM2 + 1
M (I) = 2
IS R2 (I) > RMAX
23
YES
21
20
M (I) = 1
IS R (I)≤ RMAX (I)
NO
IS DIFX (I) +
NO
40
NSUMM1 = NSUMM1 + 1
NO
661
IS R0 (I) > RMAX (I)
22
M (I) = 4
YES
SUML2 = SUML2 + 1/R2 (I)²
19
YES
18
660
NSUMM3 = NSUMM3 + 1
M (I) = 3
IS DIFY (I) +
NO
CONTINUE
26
50
A2 (I) = TAN⁻¹ (DIFY (I) – – DIFX (I))
CONTINUE
GO TO PAGE 3 B

A1

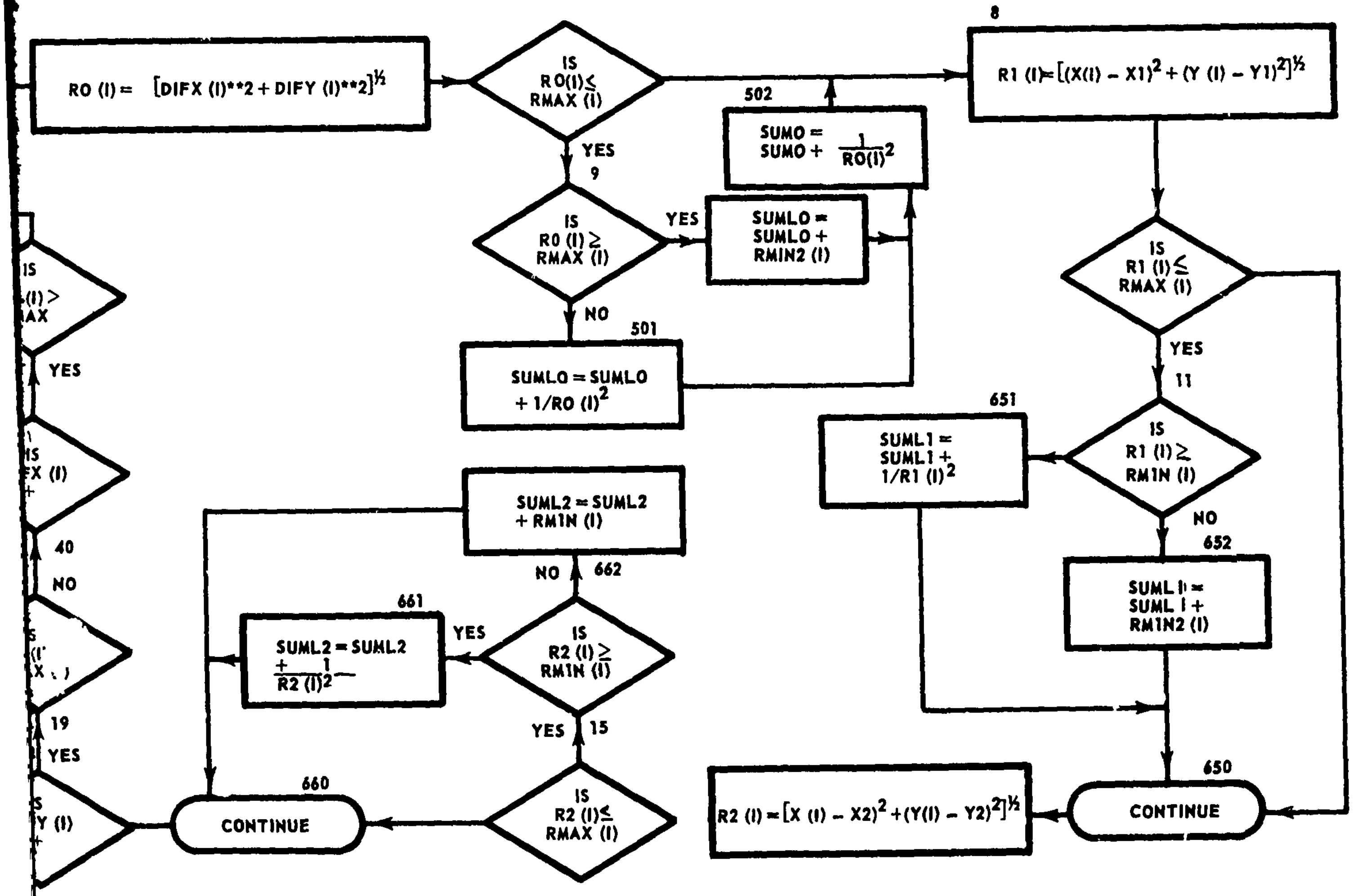
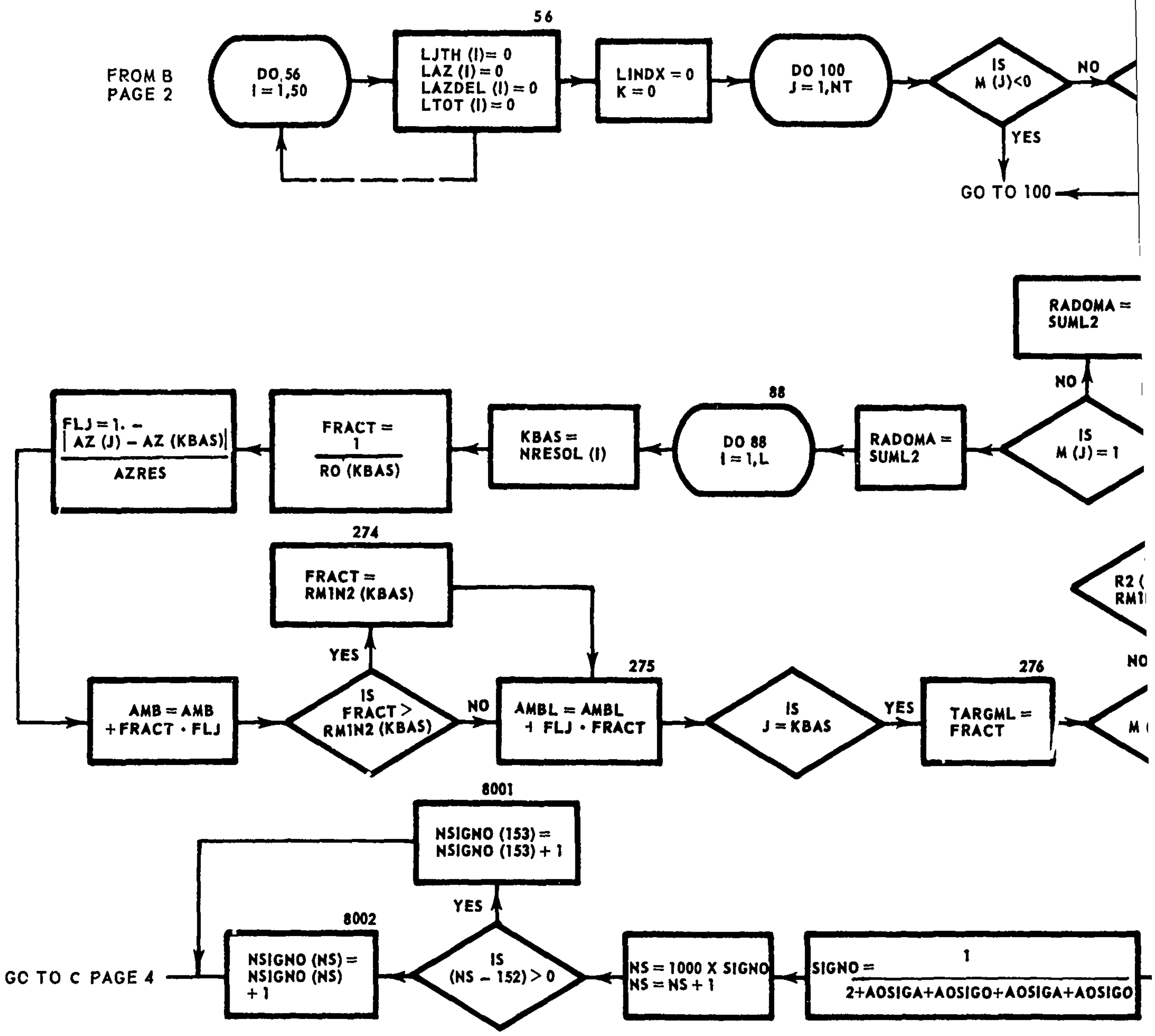


Figure 2-5 (Cont.)


FROM B PAGE 2
DO,56 I = 1,50
56
LJTH (I) = 0
LAZ (I) = 0
LAZDEL (I) = 0
LTOT (I) = 0
LINDX = 0
K = 0
DO 100 J = 1,NT
IS M (J)<0
NO
YES
GO TO 100
RADOMA = SUML2
NO
IS M (J) = 1
RADOMA = SUML2
88
DO 88 I = 1,L
KBAS = NRESOL (I)
FRACT = 1 / RO (KBAS)
FLJ = 1. - |AZ (J) - AZ (KBAS)| / AZRES
274
FRACT = RMIN2 (KBAS)
YES
AMB = AMB + FRACT · FLJ
IS FRACT > RMIN2 (KBAS)
NO
275
AMBL = AMBL + FLJ · FRACT
IS J = KBAS
YES
276
TARGML = FRACT
R2 (
RMI
NO
M (
8001
NSIGNO (153) = NSIGNO (153) + 1
YES
8002
NSIGNO (NS) = NSIGNO (NS) + 1
IS (NS - 152) > 0
NS = 1000 X SIGNO
NS = NS + 1
SIGNO = 1 / 2+AOSIGA+AOSIGO+AOSIGA+AOSIGO
GO TO C PAGE 4

A1

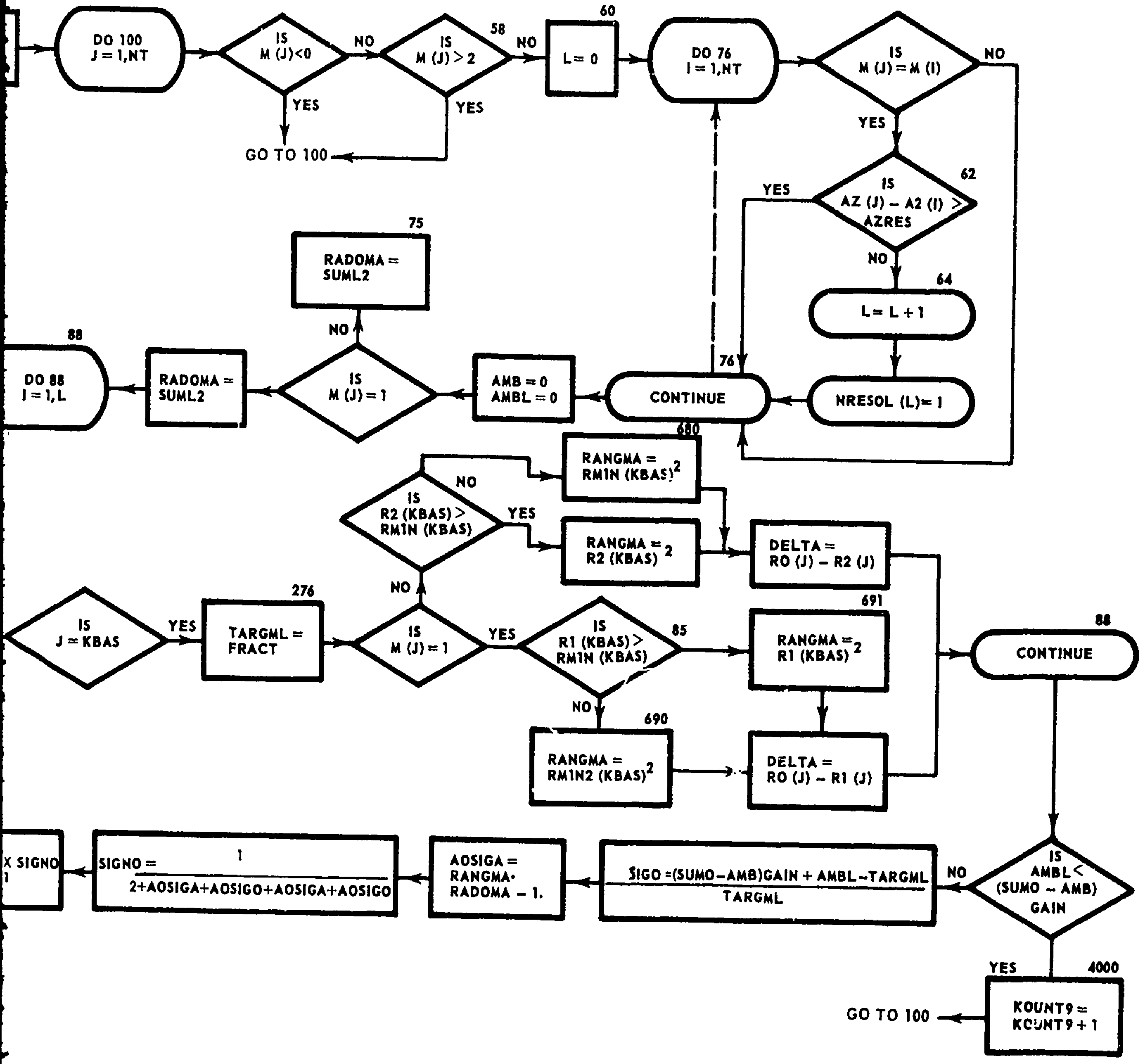
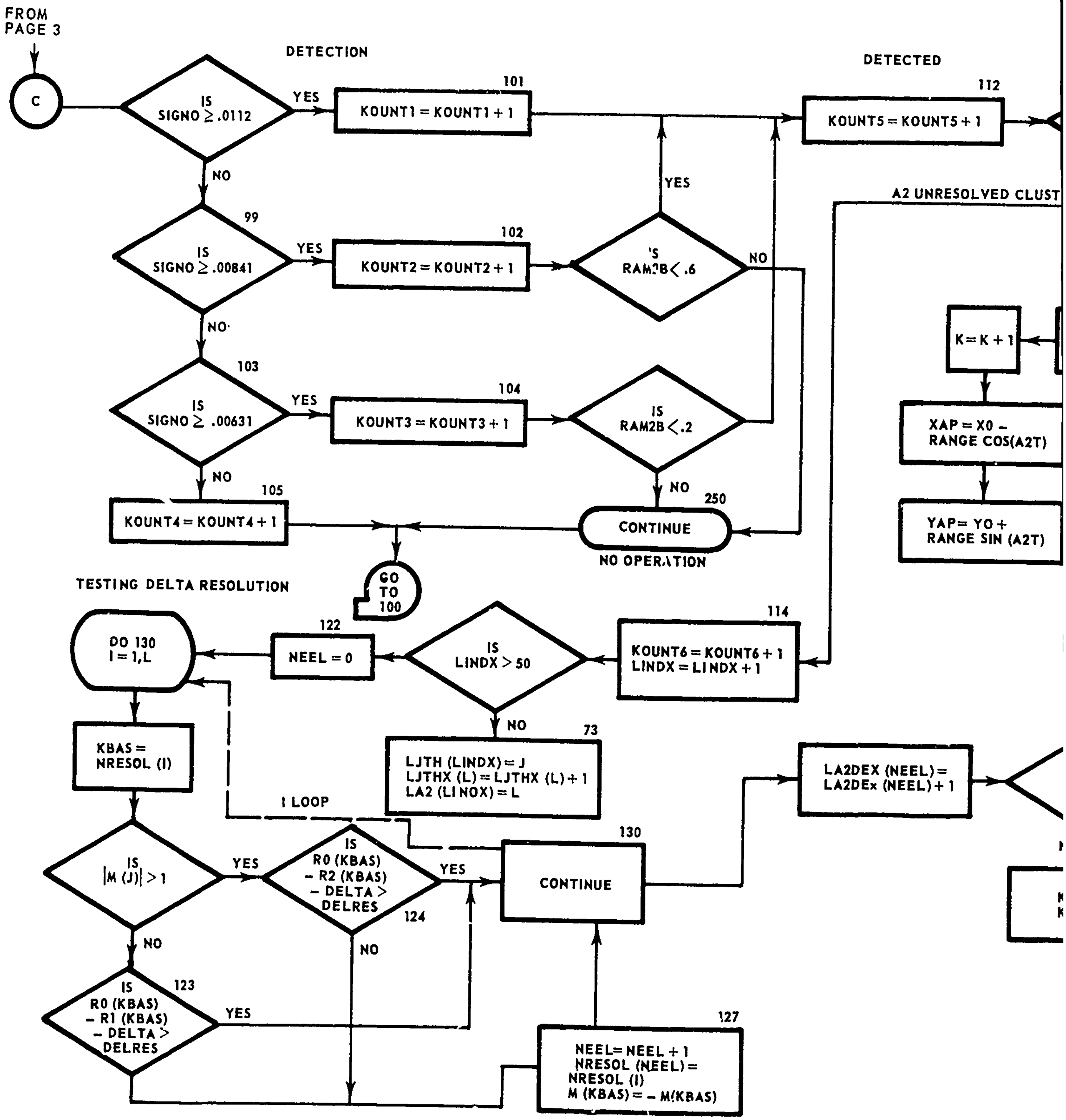


Figure 2-5 (Cont.)

B.


FROM PAGE 3
C
DETECTION
IS SIGNO ≥ .0112
YES
NO
101
KOUNT1 = KOUNT1 + 1
DETECTED
112
KOUNT5 = KOUNT5 + 1
YES
A2 UNRESOLVED CLUST
99
IS SIGNO ≥ .00841
YES
102
KOUNT2 = KOUNT2 + 1
'S RAM2B < .6
NO
NO·
K = K + 1
103
IS SIGNO ≥ .00631
YES
104
KOUNT3 = KOUNT3 + 1
IS RAM2B < .2
XAP = X0 – RANGE COS(A2T)
NO
105
KOUNT4 = KOUNT4 + 1
NO
250
CONTINUE
NO OPERATION
YAP = YO + RANGE SIN (A2T)
TESTING DELTA RESOLUTION
GO TO 100
122
114
DO 130 I = 1,L
NEEL = 0
IS LINDX > 50
KOUNT6 = KOUNT6 + 1
LINDX = LINDX + 1
NO
73
KBAS = NRESOL (I)
LJTH (LINDX) = J
LJTHX (L) = LJTHX (L) + 1
LA2 (LINOX) = L
LA2DEX (NEEL) = LA2DEx (NEEL) + 1
I LOOP
130
IS |M (J)| > 1
YES
IS R0 (KBAS) – R2 (KBAS) – DELTA > DELRES
YES
CONTINUE
124
NO
NO
IS R0 (KBAS) – R1 (KBAS) – DELTA > DELRES
123
YES
127
NEEL = NEEL + 1
NRESOL (NEEL) = NRESOL (I)
M (KBAS) = – M(KBAS)

A1

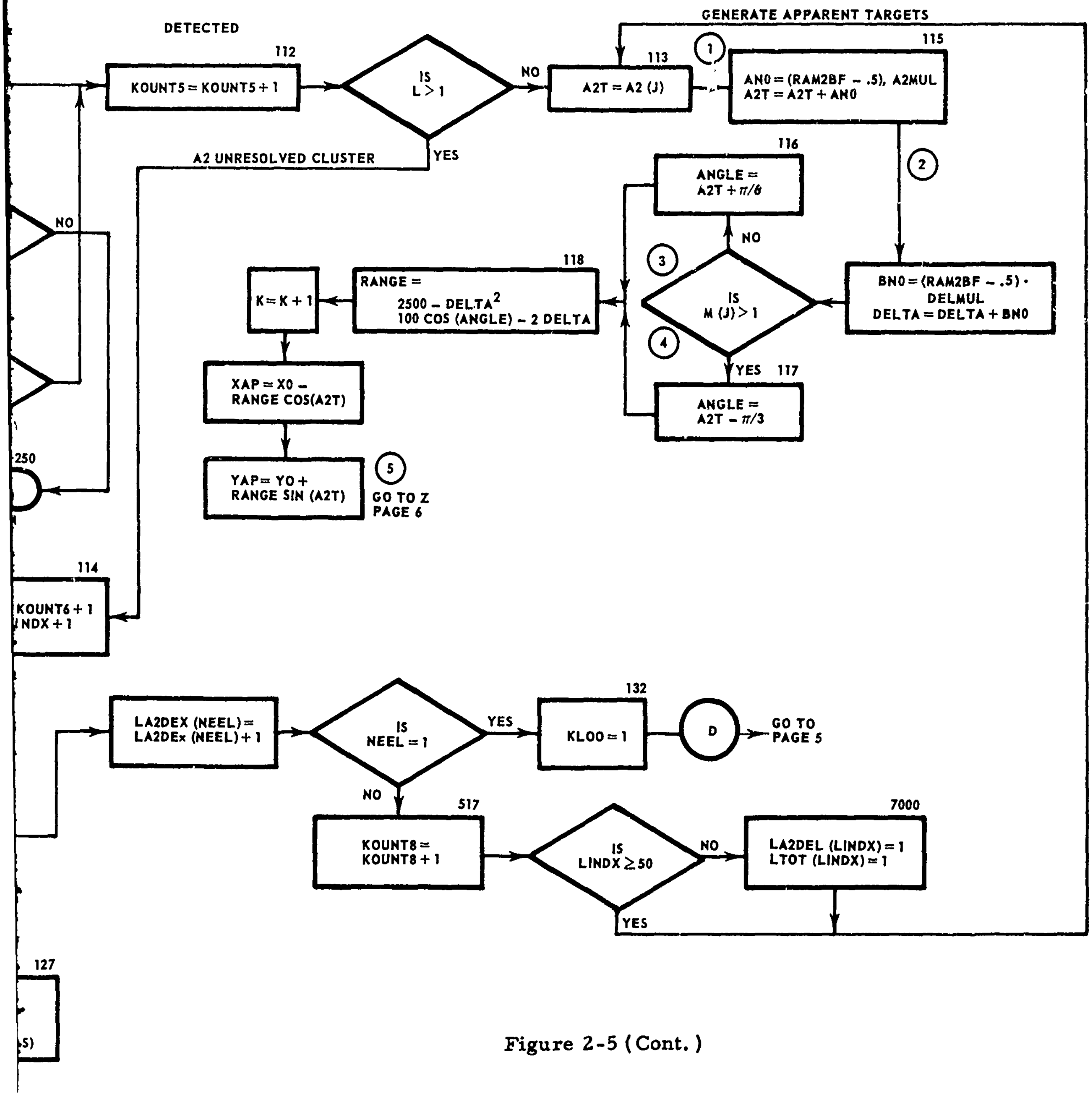
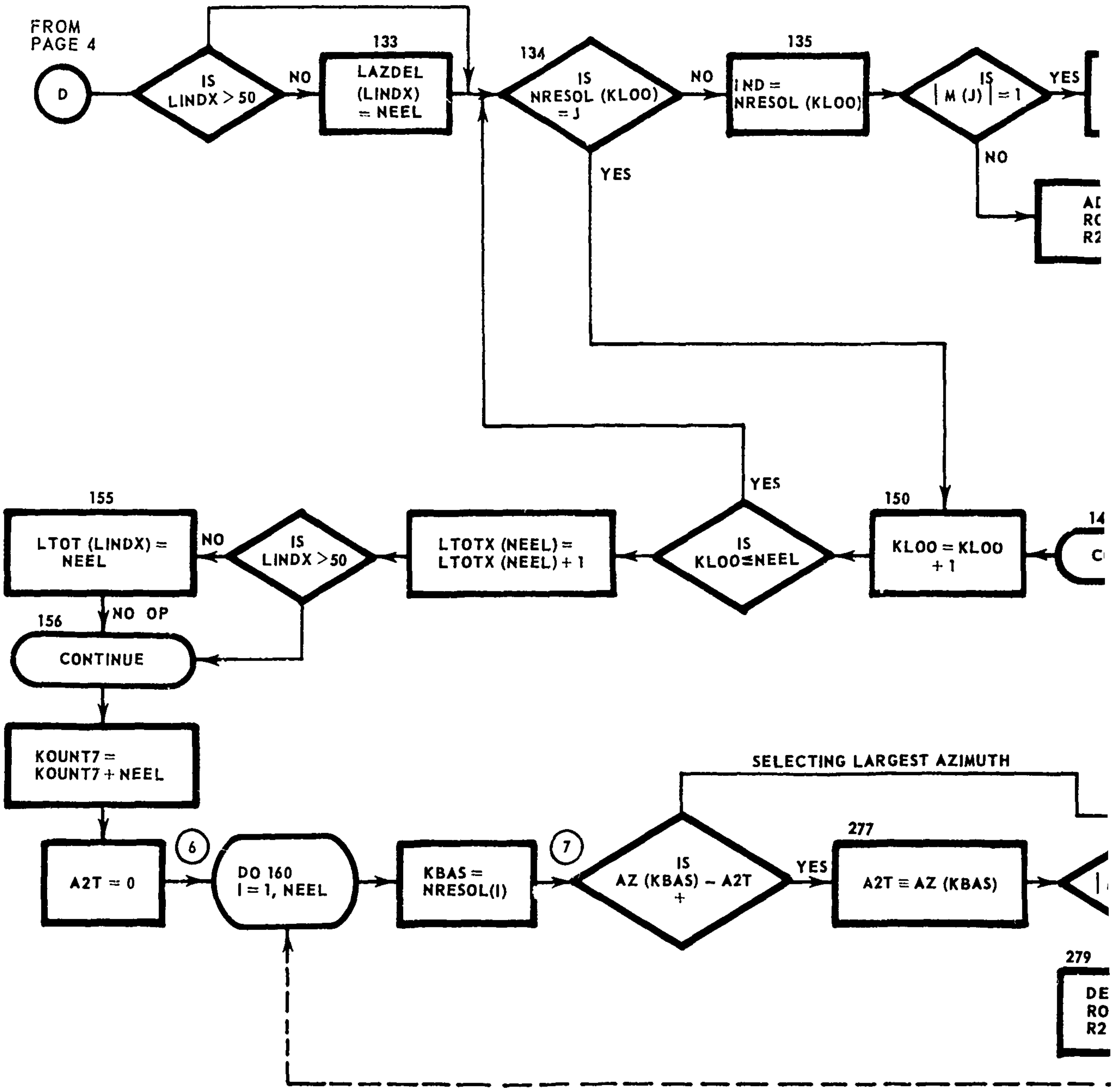


Figure 2-5 (Cont.)

B.


FROM PAGE 4
D
IS LINDX > 50
NO
133
LAZDEL (LINDX) = NEEL
134
IS NRESOL (KLOO) = J
NO
YES
135
IND = NRESOL (KLOO)
IS |M (J)| = 1
YES
NO
AD
RC
R2
YES
150
KLOO = KLOO + 1
IS KLOO≤NEEL
LTOTX (NEEL) = LTOTX (NEEL) + 1
IS LINDX >50
NO
155
LTOT (LINDX) = NEEL
NO OP
156
CONTINUE
KOUNT7 = KOUNT7 + NEEL
A2T = 0
6
DO 160 I = 1, NEEL
KBAS = NRESOL(I)
7
IS AZ (KBAS) – A2T +
YES
SELECTING LARGEST AZIMUTH
277
A2T ≡ AZ (KBAS)
279
DE
RO
R2
14
C

Fi

A1

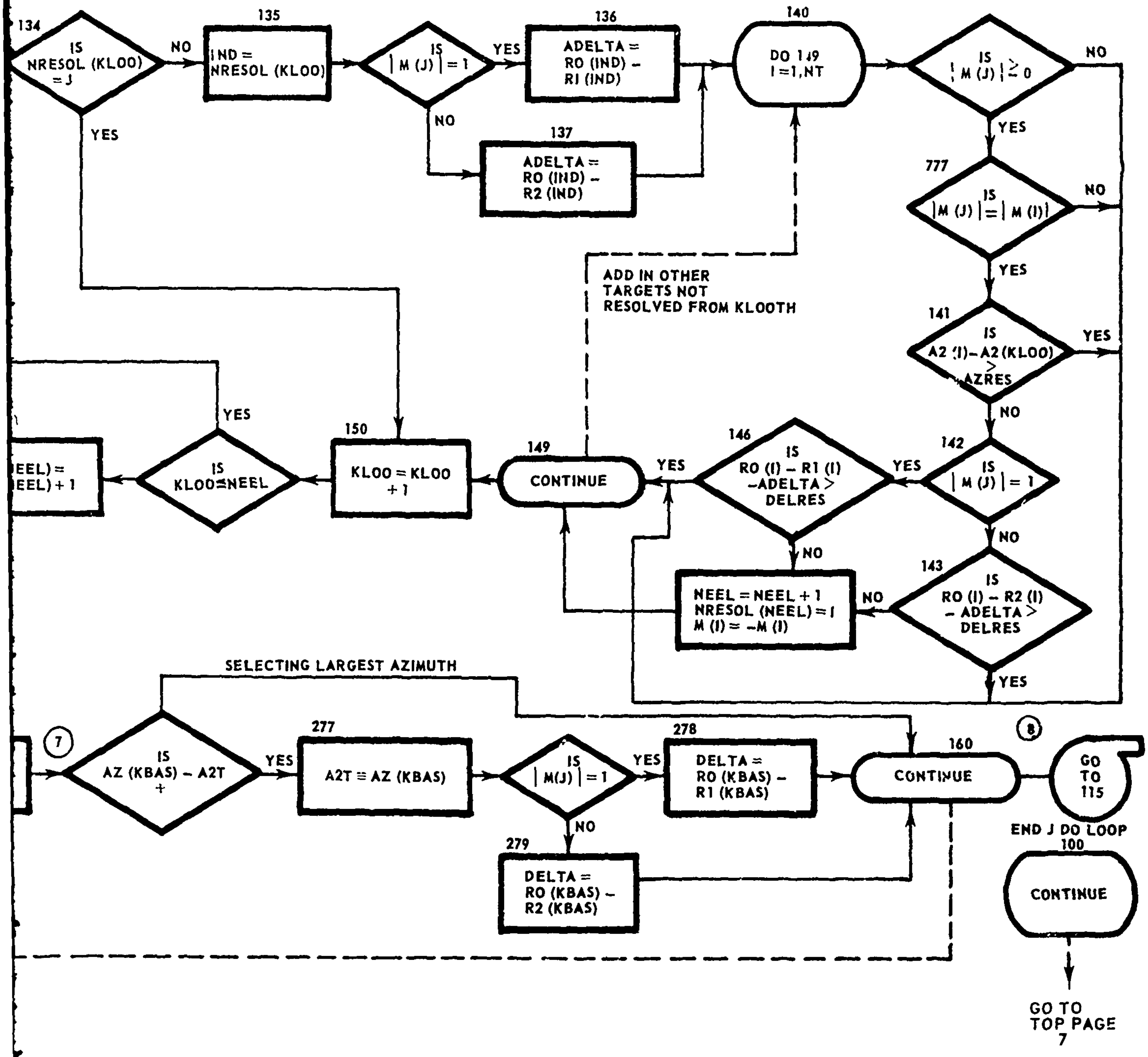


Figure 2-5 (Cont.)

B,

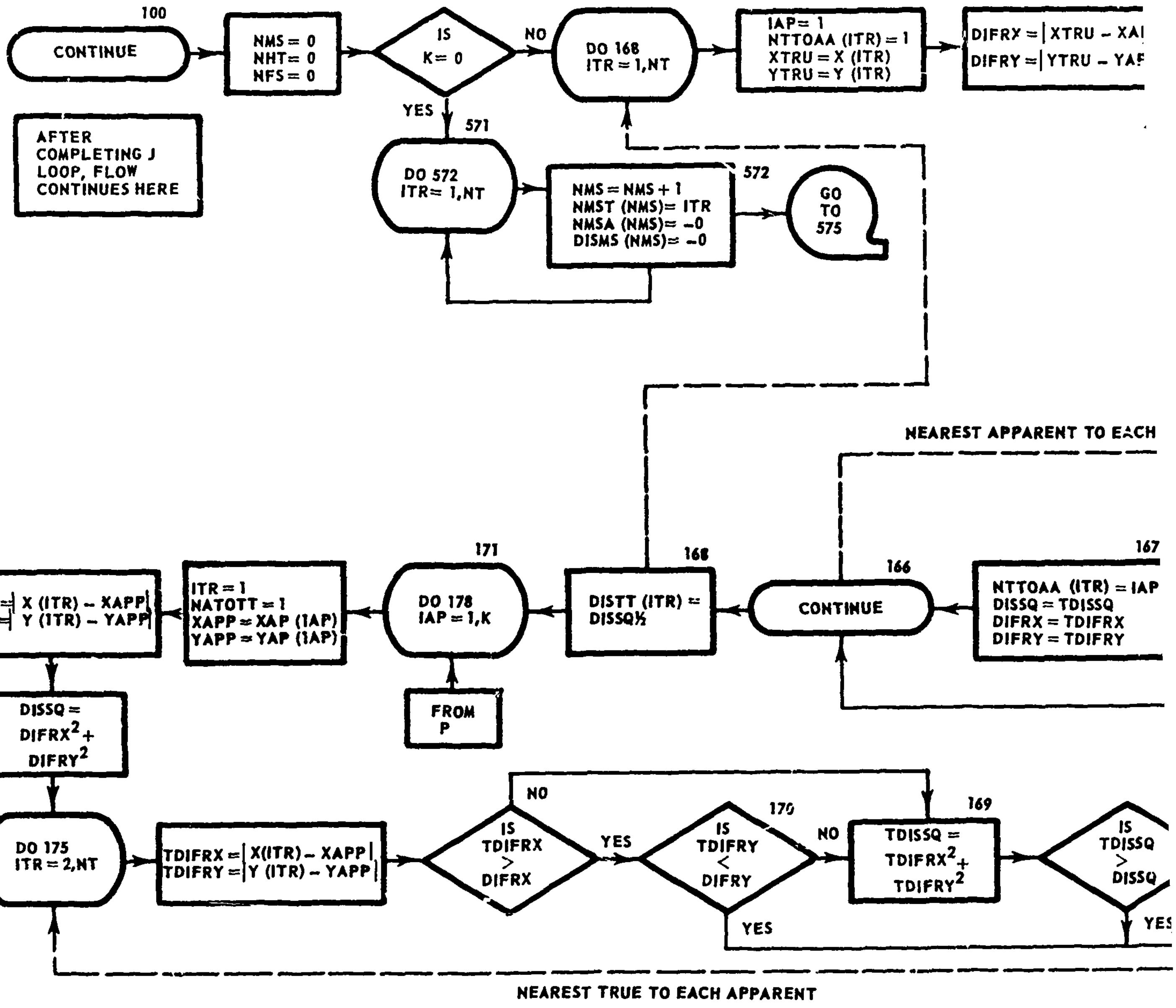

100
CONTINUE
NMS = 0
NHT = 0
NFS = 0
IS
K = 0
NO
YES
DO 168
ITR = 1,NT
IAP = 1
NTTOAA (ITR) = 1
XTRU = X (ITR)
YTRU = Y (ITR)
DIFRX = |XTRU – XA
DIFRY = |YTRU – YA
AFTER
COMPLETING J
LOOP, FLOW
CONTINUES HERE
571
DO 572
ITR = 1,NT
NMS = NMS + 1
NMST (NMS) = ITR
NMSA (NMS) = –0
DISMS (NMS) = –0
572
GO
TO
575
NEAREST APPARENT TO EACH
171
168
166
167
DIFRX = | X (ITR) – XAPP|
DIFRY = | Y (ITR) – YAPP|
ITR = 1
NATOTT = 1
XAPP = XAP (IAP)
YAPP = YAP (IAP)
DO 178
IAP = 1,K
DISTT (ITR) =
DISSQ½
CONTINUE
NTTOAA (ITR) = IAP
DISSQ = TDISSQ
DIFRX = TDIFRX
DIFRY = TDIFRY
FROM
P
DISSQ =
DIFRX² +
DIFRY²
NO
170
169
DO 175
ITR = 2,NT
TDIFRX = | X(ITR) – XAPP |
TDIFRY = | Y (ITR) – YAPP |
IS
TDIFRX
>
DIFRX
YES
IS
TDIFRY
<
DIFRY
NO
TDISSQ =
TDIFRX² +
TDIFRY²
IS
TDISSQ
>
DISSQ
YES
YES
NEAREST TRUE TO EACH APPARENT

Figure 2

A.

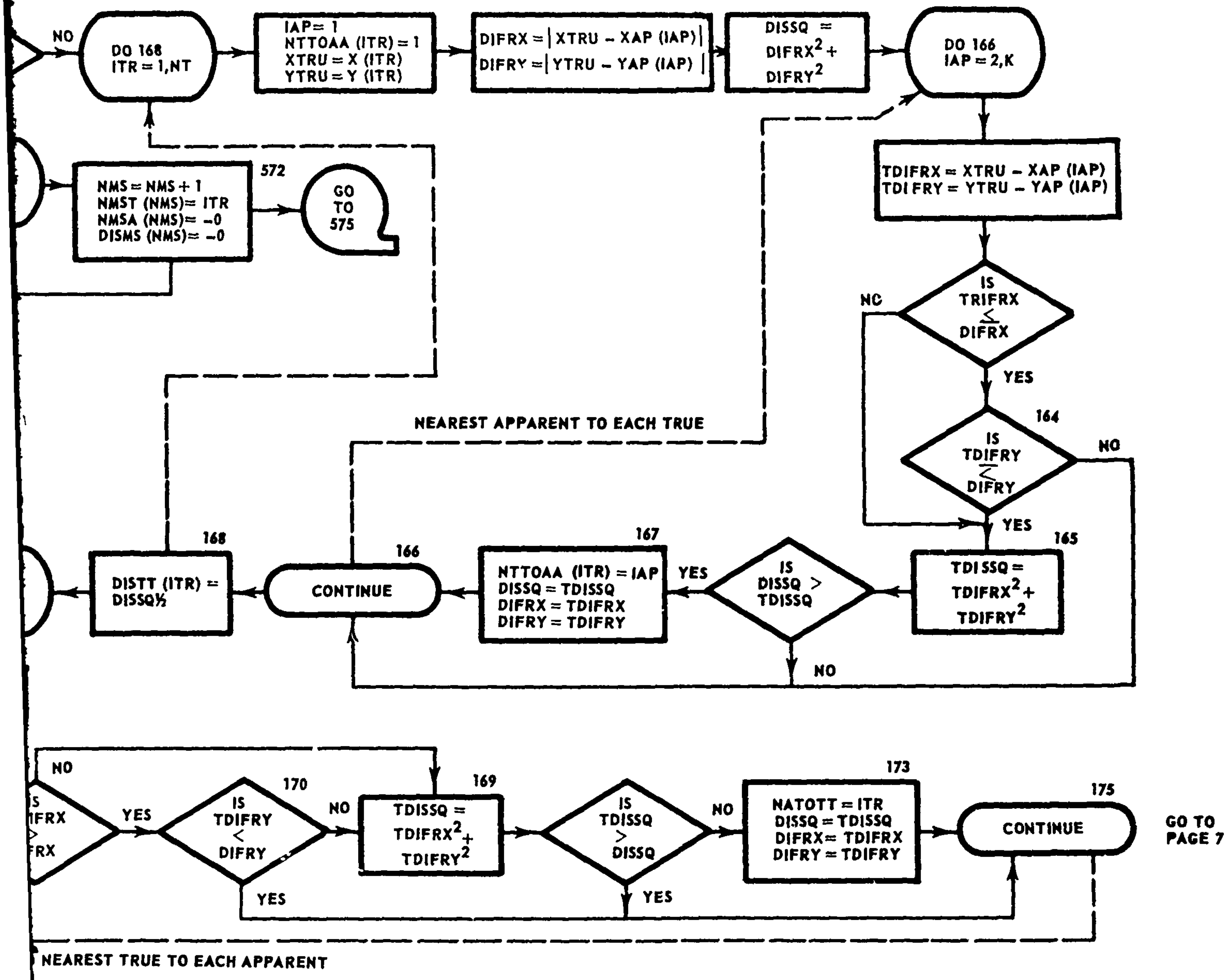
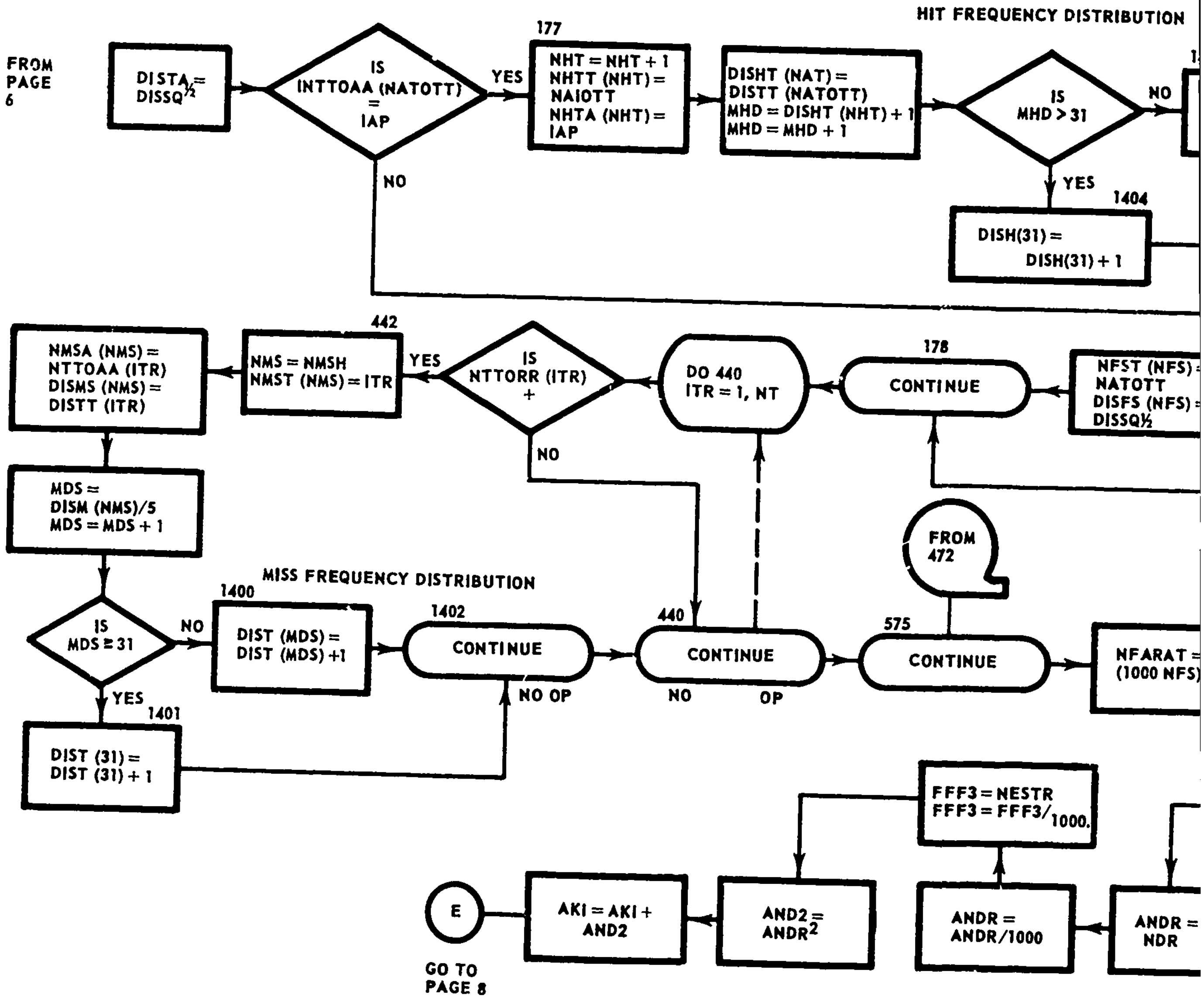


Figure 2-5(Cont.)

B.


HIT FREQUENCY DISTRIBUTION
FROM PAGE 6
DISTA = DISSQ½
IS INTTOAA (NATOTT) = IAP
YES
NO
177
NHT = NHT + 1
NHTT (NHT) = NAIOTT
NHTA (NHT) = IAP
DISHT (NAT) = DISTT (NATOTT)
MHD = DISHT (NHT) + 1
MHD = MHD + 1
IS MHD > 31
NO
YES
1404
DISH(31) = DISH(31) + 1
442
NMSA (NMS) = NTTOAA (ITR)
DISMS (NMS) = DISTT (ITR)
NMS = NMSH
NMST (NMS) = ITR
YES
IS NTTORR (ITR) +
NO
DO 440 ITR = 1, NT
178
CONTINUE
NFST (NFS)
NATOTT
DISFS (NFS)
DISSQ½
MDS = DISM (NMS)/5
MDS = MDS + 1
FROM 472
MISS FREQUENCY DISTRIBUTION
1400
IS MDS ≥ 31
NO
DIST (MDS) = DIST (MDS) +1
1402
CONTINUE
NO OP
440
CONTINUE
NO
OP
575
CONTINUE
NFARAT =
(1000 NFS)
YES
1401
DIST (31) = DIST (31) + 1
FFF3 = NESTR
FFF3 = FFF3/1000.
E
GO TO PAGE 8
AKI = AKI + AND2
AND2 = ANDR²
ANDR = ANDR/1000
ANDR =
NDR

A.

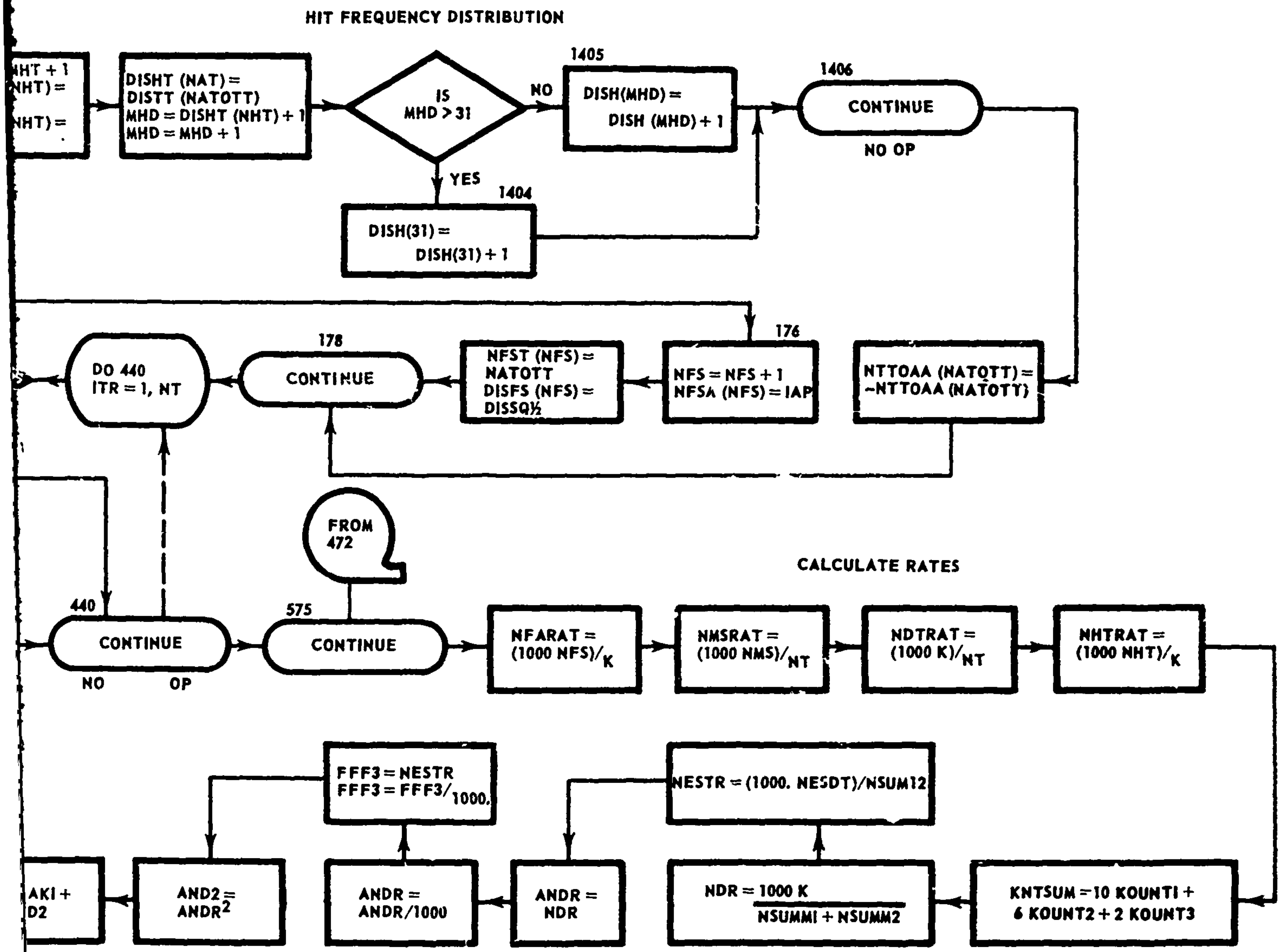
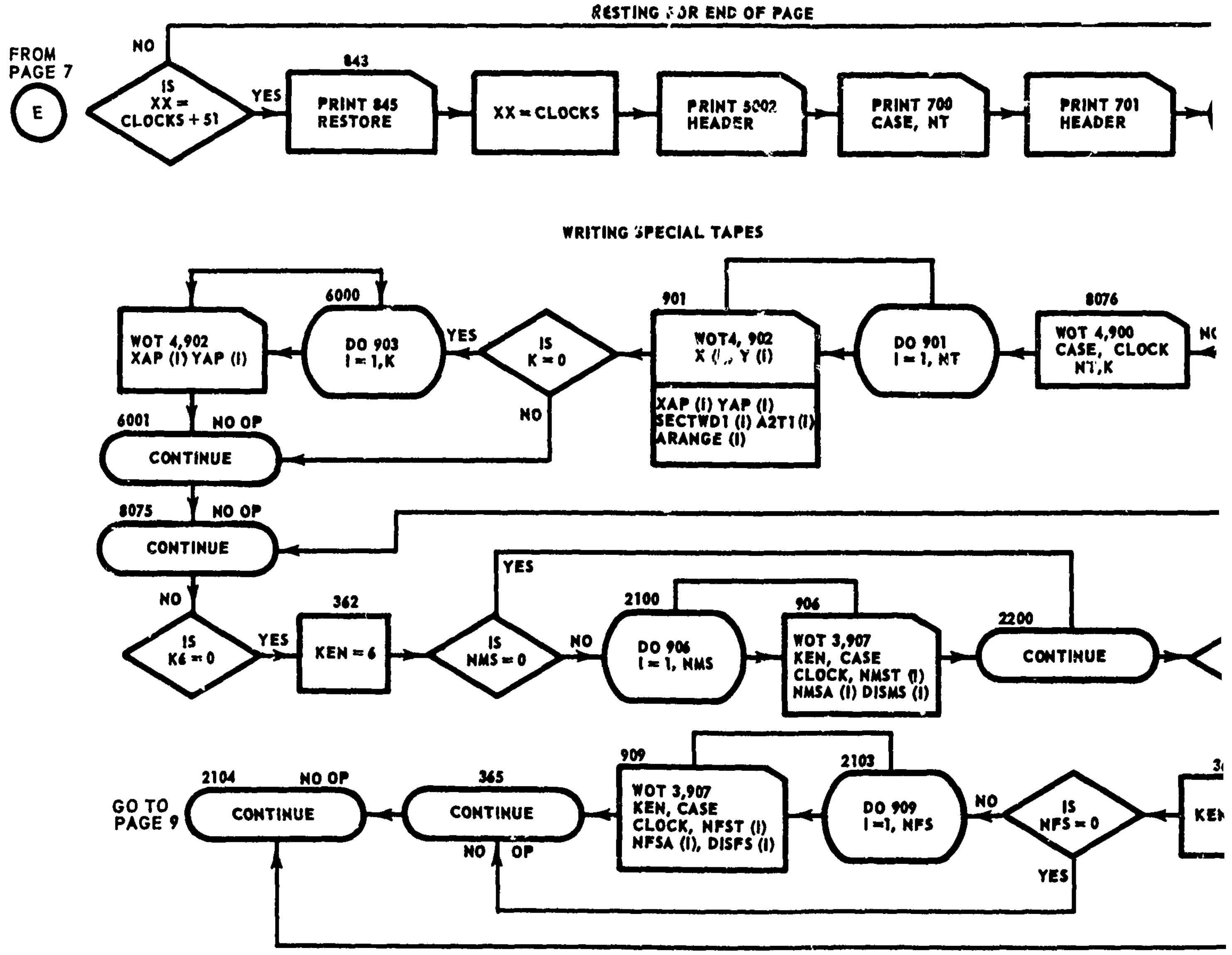


Figure 2-5 (Cont.)

B,


RESTING FOR END OF PAGE
FROM PAGE 7
E
NO
IS XX = CLOCKS + 51
YES
843
PRINT 845 RESTORE
XX = CLOCKS
PRINT 5002 HEADER
PRINT 700 CASE, NT
PRINT 701 HEADER
WRITING SPECIAL TAPES
6000
WOT 4,902 XAP (I) YAP (I)
DO 903 I = 1,K
YES
IS K = 0
NO
901
WOT4, 902 X (I), Y (I)
XAP (I) YAP (I) SECTWD1 (I) A2T1 (I) ARANGE (I)
DO 901 I = 1, NT
8076
WOT 4,900 CASE, CLOCK NT,K
NO
6001
NO OP
CONTINUE
8075
NO OP
CONTINUE
NO
IS K6 = 0
YES
362
KEN = 6
YES
IS NMS = 0
NO
2100
DO 906 I = 1, NMS
906
WOT 3,907 KEN, CASE CLOCK, NMST (I) NMSA (I) DISMS (I)
2200
CONTINUE
2104
NO OP
GO TO PAGE 9
CONTINUE
365
CONTINUE
NO OP
909
WOT 3,907 KEN, CASE CLOCK, NFST (I) NFSA (I), DISFS (I)
2103
DO 909 I =1, NFS
NO
IS NFS = 0
YES
KEN

A1

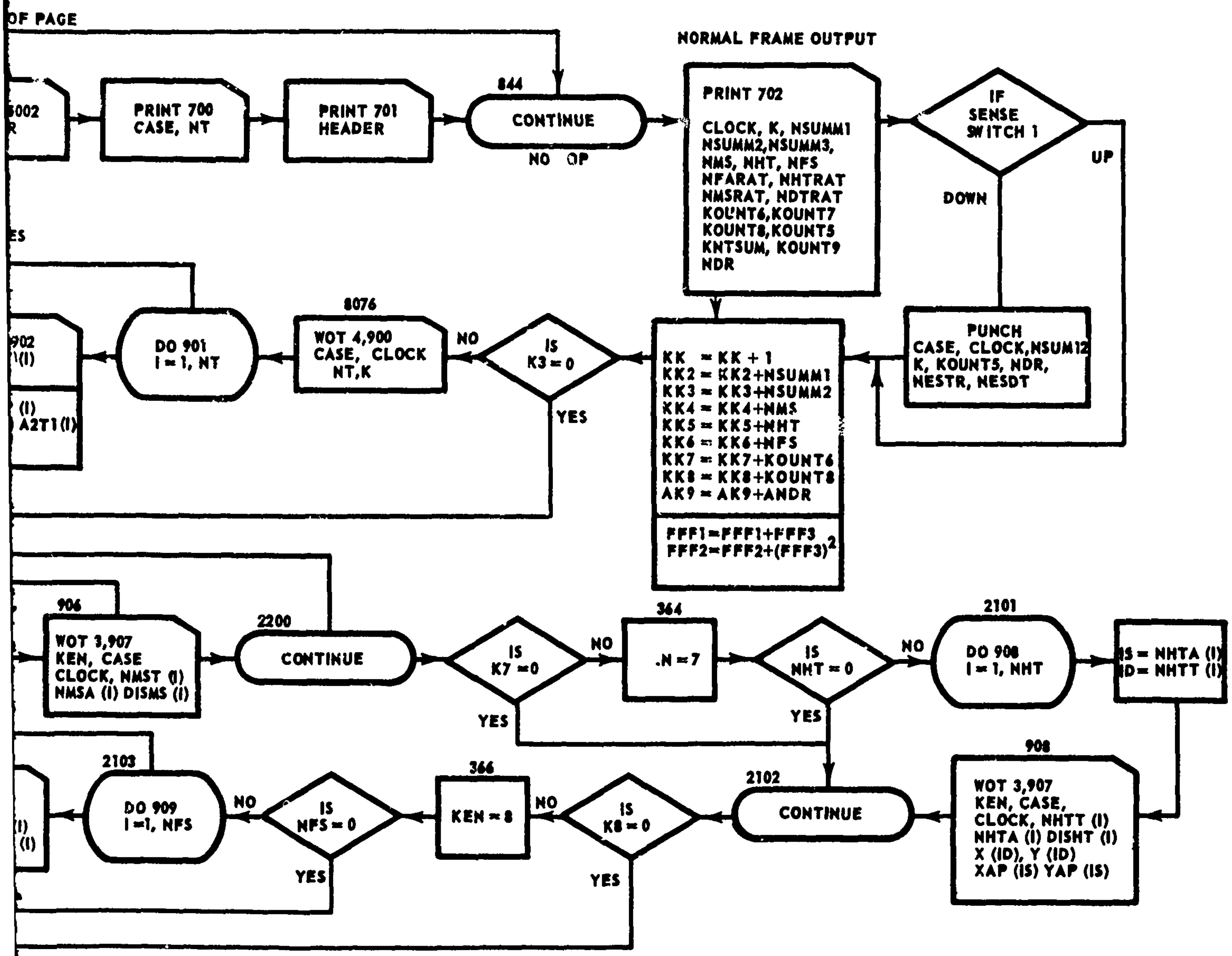
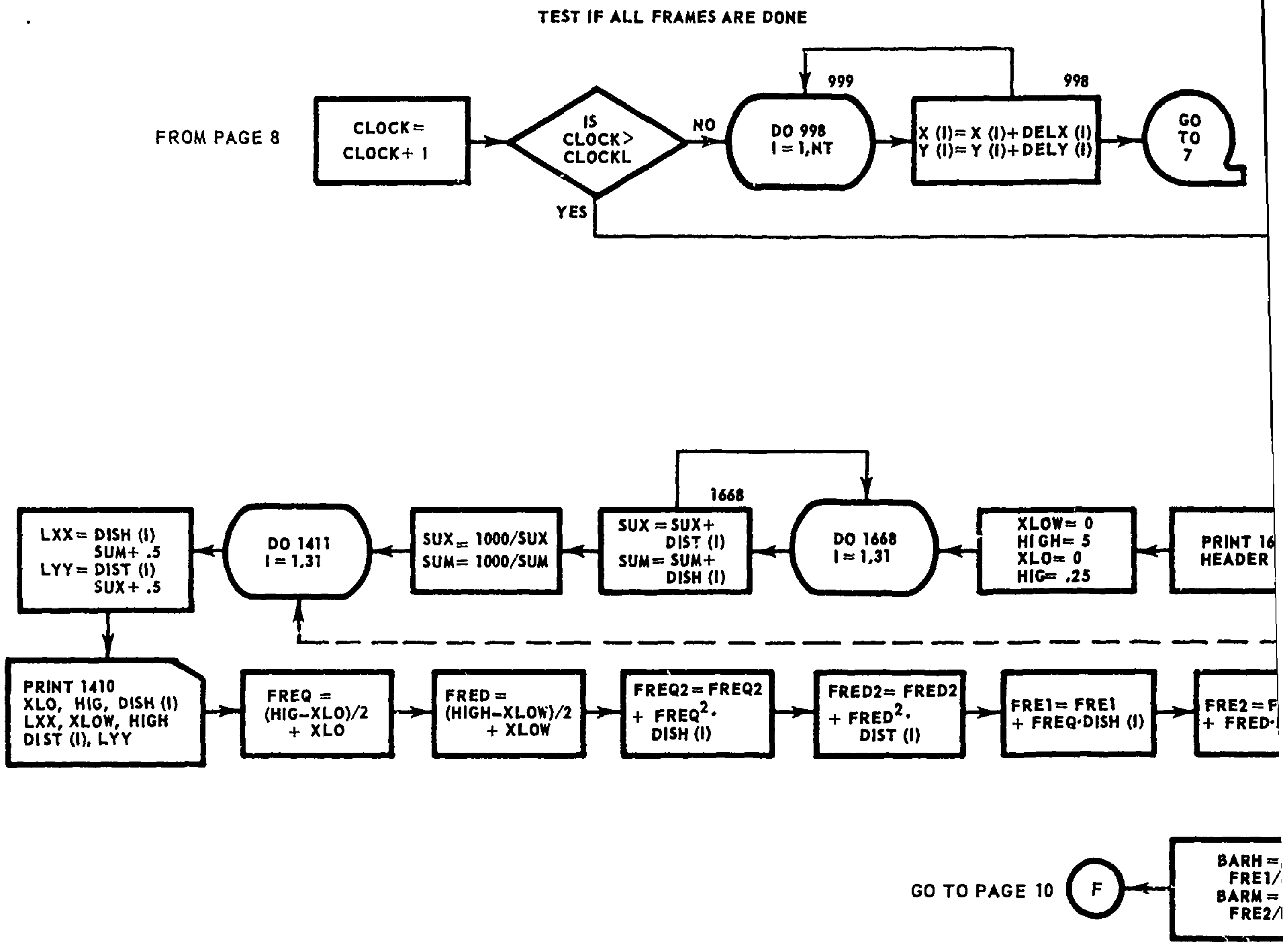


Figure 2-5 (Cont.)

B.


TEST IF ALL FRAMES ARE DONE
FROM PAGE 8
CLOCK= CLOCK+ 1
IS CLOCK> CLOCKL
NO
YES
999
998
DO 998 I = 1,NT
X (I)= X (I)+ DELX (I)
Y (I)= Y (I)+ DELY (I)
GO TO 7
1668
LXX= DISH (I) SUM+ .5
LYY= DIST (I) SUX+ .5
DO 1411 I = 1,31
SUX= 1000/SUX
SUM= 1000/SUM
SUX = SUX+ DIST (I)
SUM= SUM+ DISH (I)
DO 1668 I = 1,31
XLOW= 0
HIGH= 5
XLO= 0
HIG= .25
PRINT 16
HEADER
PRINT 1410
XLO, HIG, DISH (I)
LXX, XLOW, HIGH
DIST (I), LYY
FREQ = (HIG-XLO)/2 + XLO
FRED = (HIGH-XLOW)/2 + XLOW
FREQ2 = FREQ2 + FREQ2· DISH (I)
FRED2= FRED2 + FRED2· DIST (I)
FRE1= FRE1 + FREQ·DISH (I)
FRE2 = F + FRED·
GO TO PAGE 10
F
BARH =
FRE1/
BARM =
FRE2/

Figu

A,

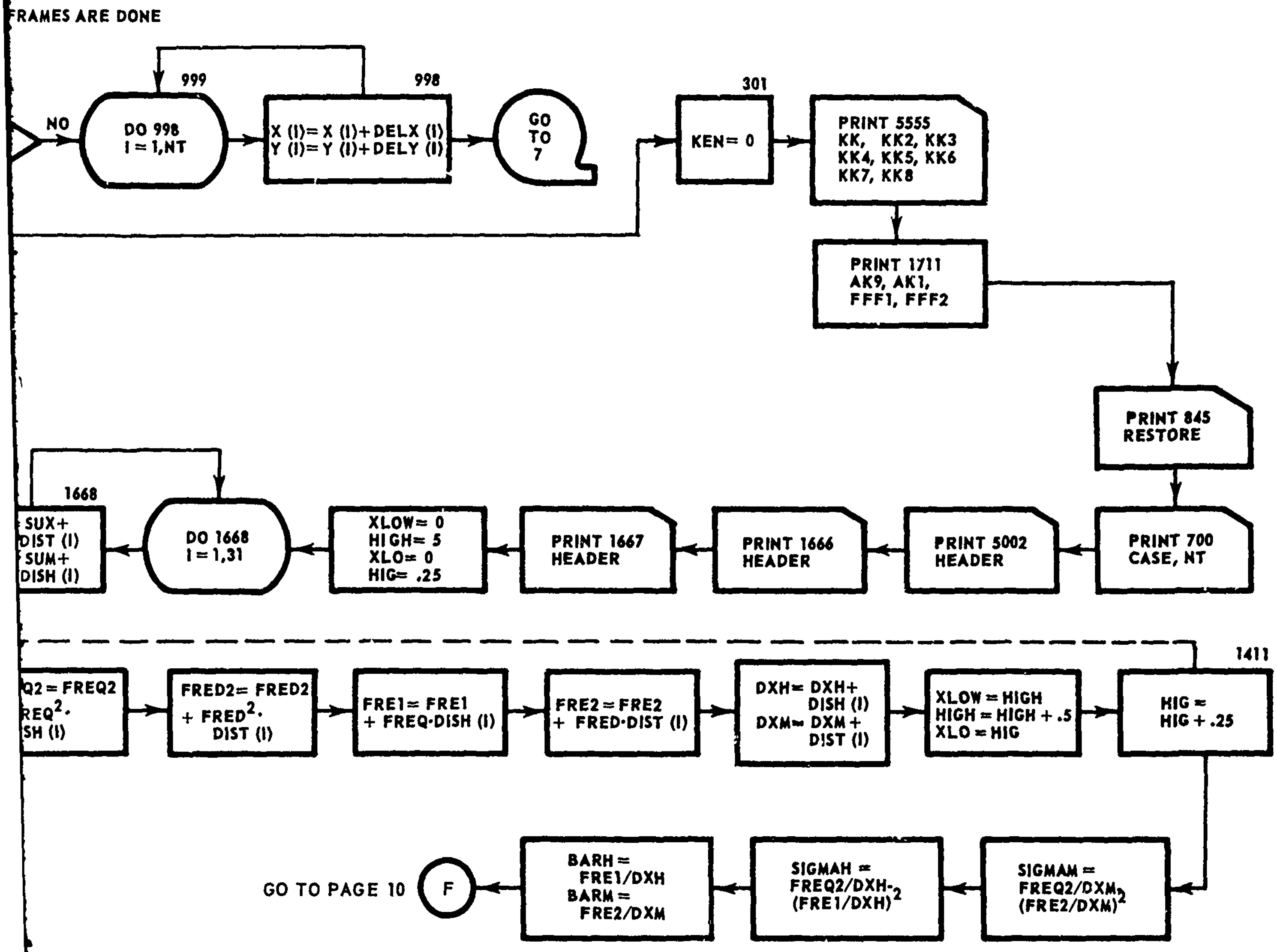


Figure 2-5 (Cont.)

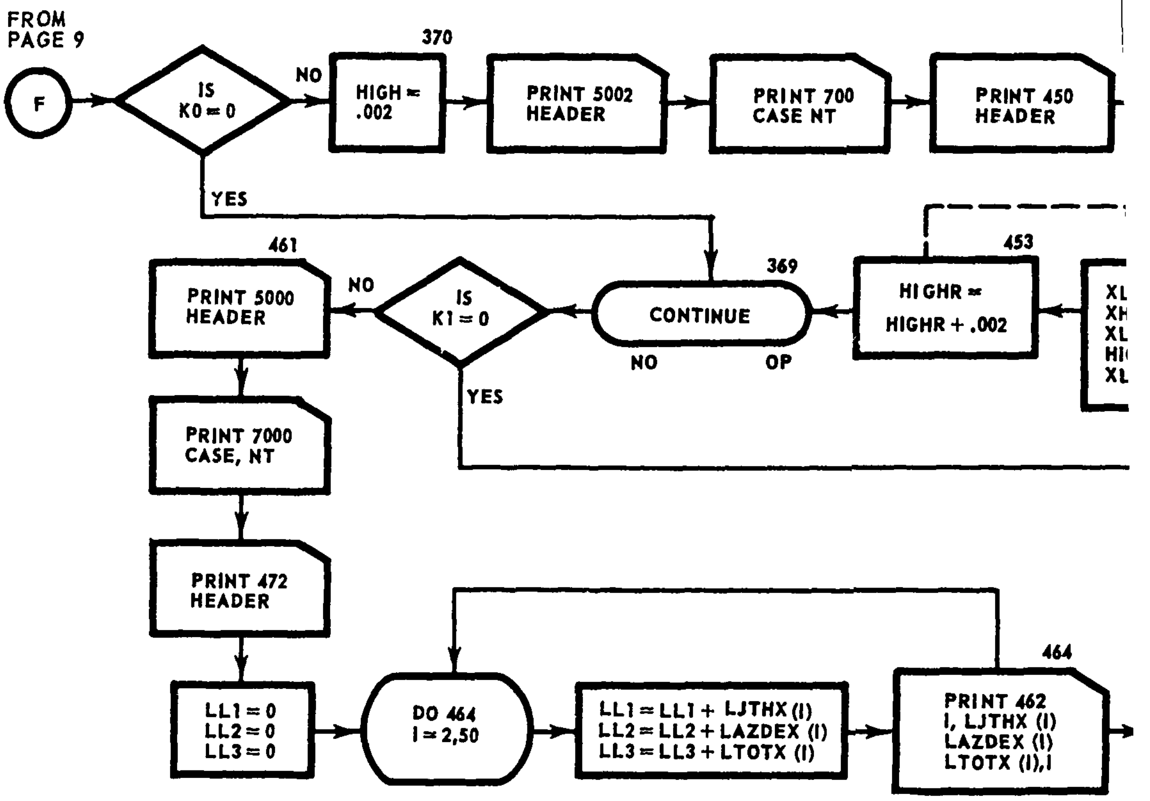

FROM PAGE 9
F
IS K0 = 0
NO
YES
370
HIGH = .002
PRINT 5002 HEADER
PRINT 700 CASE NT
PRINT 450 HEADER
453
HIGHR = HIGHR + .002
XL
XH
XL
HI
XL
369
CONTINUE
NO
OP
IS K1 = 0
NO
YES
461
PRINT 5000 HEADER
PRINT 7000 CASE, NT
PRINT 472 HEADER
LL1 = 0
LL2 = 0
LL3 = 0
DO 464 I = 2,50
LL1 = LL1 + LJTHX (I)
LL2 = LL2 + LAZDEX (I)
LL3 = LL3 + LTOTX (I)
464
PRINT 462 I, LJTHX (I) LAZDEX (I) LTOTX (I),I

Figure 2-

A

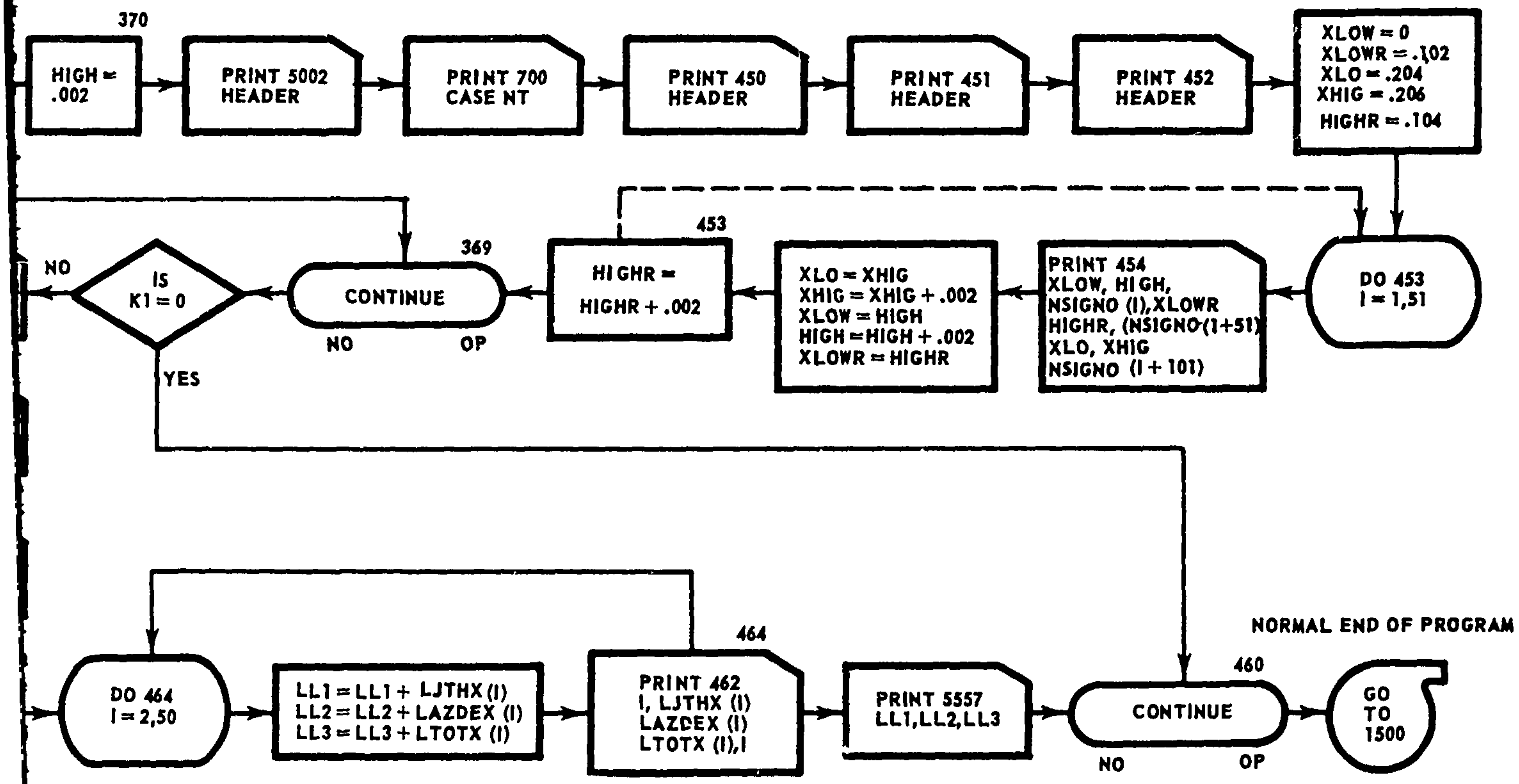


Figure 2-5 (Cont.)

B.

2.6 HISTORICAL DATA PROGRAM

Inputs to the Historical Data Program are from tape and cards. The tape input contains the information to be analyzed. The input cards contains the information designating the specific case and specific frames on tape to be analyzed. At the start and finish of each subprogram, a hollerith card is read and printed. These hollerith cards are used to convey specific operating instructions to the machine operator. The hollerith cards are themselves inputs and care should be taken to keep them in correct order.

1. Card inputs to the continuity subprogram

Card 1)	Hollerith Card	(read at beginning of analysis)
Card 2)	Variable Card	CASE1 (F5.0), START1 (F5.0), END1(F5.0), START3 (F5.0), END3 (F5.0), NT
Card 3)	Hollerith Card	(read at end of analysis)

2. Card inputs to the miss distance subprogram

Card 1)	Hollerith Card	(read at beginning of subprogram)
Card 2)	Variable Card	CASE2 (F4.0), START2 (F4.0), END2 (F4.0), RAINTR (F3.0), AZINTR (F3.0), K1 (12)
Card 3)	Hollerith Card	(read at end of analysis

Output from the continuity subprogram will be printed, or punched cards, or tape.

2.6.1 Glossary

<u>A</u> — A dummy storage location used read the X variable from tape while searching tape for desired position where analysis begins

AMDIST	Arithmetic mean, computed on the number of entires in each of the specific RA/AZ blocks for either (1) the missed distance in a "hit" pair, (2) the difference in ranges in a "hit" pair, or (3) the difference in azimuths in a "hit" pair
AZ	True target azimuth
AZAPP	Apparent target azimuth
AZINTR	Number of azimuth intervals used in the miss distance analysis
AZMID	Midpoints of the various azimuth intervals
B	Dummy location, used to store the Y variable while reading tape to locate the correct starting position
C	Dummy location, used to store the XAP variable while reading tape to locate the correct starting position
CASE	Identification number for a case
CASE 1	The case to be analyzed in the continuity subprogram
CASE 2	The case to be analyzed in the miss-distance subprogram
CLOCK	Frame identification
CLOCKA	Frame identification
COUNTR	A counter used to determine (and correct) the possibility of encountering blank frames while processing tapes
D	Dummy location used to store the XAP variable while reading tape to locate the correct starting position

DENOM The total number of frames processed

DISHT The distance between a true target and an apparent target in a "hit" pair

DIST The summation of the specific difference variable (HARRY) for each of the RA/AZ blocks

DIST 1 Square of DIST ($DIST^2$)

DIST 2 This variable is the number of observed targets (XOBSVN) in a RA/AZ section multiplied by the sum of squares of HARRY ($\Sigma (HARRY)^2$)

DISTSQ Summation of $(HARRY)^2$

E Dummy location used to store the YAP variable while input tape is searched for correct starting position

END 1 Last frame to be processed with respect to the binary tape output section

END 2 Last frame to be processed with respect to the miss-distance subprogram

END 3 Last frame to be processed with respect to the continuity subprogram analysis

HARRY The miss-distance subprogram is capable of performing analysis in either the three separate modes (i.e., (1) the frequency analysis is performed with respect to :he distance between the true and the apparent target in a "hit" pair (2) the frequency analysis is performed with respect to the difference in ranges between the true and apparent in a "hit" pair (3) the frequency analysis is performed with respect to the differences in ranges between the true and apparent target in a "hit" pair); HARRY serves as a common location for each of these cases

II — The number of range intervals (RAINTR) used as a DO LOOP limit

JJ — The number of azimuth intervals (AZINTR) used as a DO LOOP limit

KEN — Identification number for different types of historical data which were written previously on tape 3 by TLQ-8 program

KMAX — Number of detections per frame

K 1 — Control constant used to control the specific analytic modes

1) K1 = 1 analysis is performed on DISHT

2) K1 = 2 analysis is performed on "difference in ranges" (see HARRY)

3) K1 = 3 analysis is performed on "difference in azimuths" (see HARRY)

MCASE — Same as CASE

MF — The number of frames encountered during the tape analysis in which no detections occurred

MISS — The total number of frames missed per target

N — A variable used to record runs of length "N" where N is the number of consecutive missed frames ($0 \leq N \leq 15$)

NFREQ — The number of times a specific target was missed for a length of "N" consecutive frames

NHTA — The number of the apparent target in a "hit" pair

NHTT — A counter used to tabulate the number of consecutive missed frames for the individual targets

NT	Number of targets
N1	Dummy location used to store the variable NHTT while searching tape for the correct tape
N2	Dummy location used to store the variable NHTA while searching tape for the correct tape
RA	True target range
RAMID	Midpoints of the range intervals
RAINTR	Number of range intervals used in the miss distance subprogram
RAPP	Range of the apparent target
RATE	The ratio of the total number of times a target was missed to the maximum number of misses possible
RAIVSZ	The specific size of the range intervals
STADEV	Standard deviation
START 1	Starting frame for the binary tape output
START 2	Starting frame for analysis in the miss distance subprogram
START 3	Starting frame for the continuity analysis
TOP	See MISS
X	X coordinate of the true target
XAP	X coordinate of the apparent target
XOBSVN	The number of targets observed in a specific RA/AZ interval

XOBS11 (XOBSVN)(XOBSVN-1)

Y Y coordinate of the true target

YAP Y coordinate of the apparent target

2.6.2 FORTRAN Listing

```
   DIMENSION NMISS(60),NFREQ(60,15),NHTT(60),NHTA(60),DISHT(60),X(60)
  1,Y(60),XAP(60),YAP(60),RA(60),AZ(60),RAPP(60),AZAPP(60),XOBSVN(25,
  218),DIST(25,18),DISTSQ(25,18),RAMID(18),AZMID(25),AMDIST(60),
  3VARNCE(60),STADEV(60),M(60)
 5 READ 6
 6 FORMAT(72H
  X
   PRINT 6
   PAUSE 1
   IF(SENSE SWITCH2)20,10
20 REWIND 3
   END FILE 4
   REWIND 4
   GO TO 5
10 IF(SENSE SWITCH 1)40,30
30 READ 31,CASE1,START1,END1,START3,END3,NT
31 FORMAT(5F5.0,I3)
   COUNTR=START1
   MF=0
   DO 50 J=1,NT
   M(J)=0
   NMISS(J)=0
   DO 50 N=1,15
50 NFREQ(J,N)=0
   SENSE LIGHT 1
   SENSE LIGHT 2
   SENSE LIGHT 3
   SENSE LIGHT 4
   I=1
60 READ INPUT TAPE 3,61,KEN,CASE,CLOCKA,N1,N2,A,B,C,D,E
61 FORMAT(I5,F10.5,F5.0,2I8,5F8.2)
62 IF(SENSE LIGHT 1)65,75
65 SENSE LIGHT 1
   IF(CASE1-CASE)71,70,71
 71 IF(KEN-7)72,60,72
 72 PRINT 73,KEN,CLOCKA
 73 FORMAT(39H KEN ISNOT EQUAL TO 7. CHECK TAPE. KEN=I3,7H CLOCK=I4)
    PAUSE 2
 70 IF(SENSE LIGHT 1)75,75
 75 IF(SENSE LIGHT 2)80,85
 85 IF(SENSE LIGHT 3)402,403
402 SENSE LIGHT 3
    GO TO 401
 80 SENSE LIGHT 2
    IF(START1-CLOCKA)400,400,71
400 IF(SENSE LIGHT 2)401,401
401 IF(START3-CLOCKA+1.)81,416,87
 81 MF=CLOCKA-START3
    DO 82 K=1,MF
    DO 82 J=1,NT
 82 NMISS(J)=NMISS(J)+1
    COUNTR=COUNTR+FLOATF(MF)
    MF=0
416 IF(SENSE LIGHT 3)403,403
403 IF(CASE1-CASE)92,87,92
 92 IF(END3-CLOCK)93,87,93
 93 MF=END3-CLOCK
 87 IF(I-1)89,88,89
 88 CLOCK=CLOCKA
 89 IF(CLOCKA-CLOCK)95,91,95
 95 COUNTR=COUNTR+1.
    IF(CLOCKA-COUNTR)96,90,96
 96 MF=CLOCKA-COUNTR
    COUNTR=COUNTR+FLOATF(MF)
    GO TO 90
 91 NHTT(I)=N1
    NHTA(I)=N2
    DISHT(I)=A
    X(I)=B
    Y(I)=C
    XAP(I)=D
    YAP(I)=E
    I=I+1
    GO TO 60
 90 KMAX=I-1
    WRITE TAPE 4,CASE1,CLOCK,KMAX
    WRITE TAPE 4,(X(I),Y(I),XAP(I),YAP(I),DISHT(I),I=1,KMAX)
    IF(SENSE LIGHT 3)412,404
412 SENSE LIGHT 3
    GO TO 55
```

```
404 IF(SENSE LIGHT 4)407,101
407 SENSE LIGHT 4
405 DO 150 I=1,KMAX
    J=NHTT(I)
    IF(NMISS(J))150,150,146
146 N=NMISS(J)
    IF(N-15)148,148,147
147 MM=N-15
    M(J)=M(J)+MM
    N=15
148 NFREQ(J,N)=NFREQ(J,N)+1
150 NMISS(J)=-1
    DO 155 J=1,NT
155 NMISS(J)=NMISS(J)+1
    IF(MF)102,406,98
102 PRINT 103,COUNTR,CLOCKA
103 FORMAT(24H MF IS NEGATIVE. COUNTR=F4.0,8H CLOCKA=F4.0)
    PAUSE 11
 98 DO 99 K=1,MF
    DO 99 J=1,NT
 99 NMISS(J)=NMISS(J)+1
    MF=0
406 IF(END3-CLOCKA)408,101,101
408 IF(SENSE LIGHT 4)101,101
101 IF(CASE1-CASE)165,156,165
156 IF(END1-CLOCKA)165,55,55
 55 I=1
    NHTT(I)=N1
    NHTA(I)=N2
    DISHT(I)=A
    X(I)=B
    Y(I)=C
    XAP(I)=D
    YAP(I)=E
    GO TO 62
165 DO 170 J=1,NT
    IF(NMISS(J))170,170,166
166 N=NMISS(J)
    IF(N-15)168,168,167
167 MM=N-15
    M(J)=M(J)+MM
    N=15
168 NFREQ(J,N)=NFREQ(J,N)+1
170 CONTINUE
    DENOM=END3-START3+1.
    PRINT 171,CASE1,DENOM
171 FORMAT(17H   CASE ANALYZED=F4.0,26H MAXIMUM NO. OF MISSES IS F4.0)
```

```
      PRINT 172
  172 FQRMAT(120H TARGET NO.    MISSES    RATE    RUNS OF LENGTH N=  1   2
     X  3   4   5   6   7   8   9   10   11   12   13   14   15 TOTAL MISSES)
      MCASF=CASE
      DO 176 J=1,NT
      MISS=0
      DO 175 N=1,15
  175 MISS=MISS+(N*NFREQ(J,N))
      TOP=MISS+M(J)
      RATE=TOP/DENOM
      PRINT 173,J,MISS,RATE,(NFREQ(J,N),N=1,15),M(J)
  173 FORMAT(I10,I8,F9.3,I24,14I4,I9)
  176 PUNCH174,MCASE,J,MISS,RATE,(NFREQ(J,N),N=1,15)
  174 FORMAT(I3,I2,I3,F4.2,15I4)
      GO TO 5
   40 READ 41,CASF2,START2,END2,RAINTR,AZINTR,K1
   41 FORMAT(3F4.0,2F3.0,I2)
      RAIVSZ= 250./RAINTR
      AZIVSZ=3.1415927/AZINTR
      IF(SENSE SWITCH 4)410,411
  411 DO 178 I=1,25
      DO 178 J=1,18
      XOBSVN(I,J)=0.
      DIST(I,J)=0.
  178 DISTSQ(I,J)=0.
  410 SENSE LIGHT 3
      SENSF LIGHT 4
      K1=K1-2
  179 READ TAPE 4,CASE ,CLOCK,KMAX
      IF(SENSE LIGHT 3)185,180
  185 SENSE LIGHT 3
      IF(CASE2-CASE)195,190,195
  190 IF(SENSE LIGHT 3)205,205
  195 READ TAPE 4,A,B,C
      GO TO 179
  180 IF(CASE2-CASE)200,205,200
  200 PRINT 201,CASE,CASE2,CLOCK
  201 FORMAT(94H CASE NO. HAS BEEN RECORDED WRONG. ERROR COULD BE IN SEA
     XRCHING OR RECORDING TAPE 3 OR 4. CASE=F4.0,7H CASE2=F4.0,7H CLOCK=
     XF4.0)
      PAUSE 3
  205 IF(SENSE LIGHT 4)206,210
  206 SENSE LIGHT 4
      IF(CLOCK-START2)195,207,207
  207 IF(SENSE LIGHT 4)210,210
  210 READ TAPE 4,(RA(K),AZ(K),RAPP(K),AZAPP(K),DISHT(K),K=1,KMAX)
```

```
    IF(SENSE SWITCH3)392,393
392 DO 390 K=1,KMAX
390 PRINT 391,RA(K),AZ(K),RAPP(K),AZAPP(K),DISHT(K)
391 FORMAT(5F10.3)
393 IF(KMAX)220,242,220
220 DO 230 K=1,KMAX
    DIFX=RA(K)-500.
    DIFY=AZ(K)-500.
    RA(K)=SQRTF(DIFX**2+DIFY**2)
    AZ(K)=ATN1F(DIFY,-DIFX)
    DIFX=RAPP(K)-500.
    DIFY=AZAPP(K)-500.
    RAPP(K)=SQRTF(DIFX**2+DIFY**2)
230 AZAPP(K)=ATN1F(DIFY,-DIFX)
    DO 240 K=1,KMAX
    J=(RA(K)/RAIVSZ)+1.
    I=(AZ(K)/AZIVSZ)+1.
    XOBSVN(I,J)=XOBSVN(I,J)+1.
    IF(K1)231,232,233
231 HARRY=DISHT(K)
    GO TO 234
233 HARRY= ABSF(AZ(K)-AZAPP(K))
    GO TO 234
232 HARRY=ABSF(RA(K)-RAPP(K))
234 DIST(I,J)=DIST(I,J)+HARRY
    IF(SENSE SWITCH 3)300,240
300 PRINT 301,KMAX,J,I,XOBSVN(I,J),RA(K),RA PP(K),AZ(K),AZAPP(K),HARRY
301 FORMAT(3I4,6F10.3)
240 DISTSQ(I,J)=DISTSQ(I,J)+HARRY**2
242 IF(END2-CLOCK)243,245,179
243 PRINT 244,CLOCK,CASE,END2
244 FORMAT(56H ENDING FRAME NO. HAS BEEN BYPASSED. CHECK TAPES. CLOCK=
   XF4.0,6H CASE=F4.0,6H END2=F4.0)
    PAUSE 4
245 II=RAINTR
    JJ=AZINTR
    IF(SFNSE SWITCH 5)5,808
808 RAMID(1)=RAIVSZ/2.
    AZMID(1)=AZIVSZ/2.
    DO 250 I=2,II
250 RAMID(I)=RAMID(I-1)+RAIVSZ
    DO 255 I=2,JJ
255 AZMID(I)=AZMID(I-1)+AZIVSZ
    IF(K1)260,261,262
260 PRINT 263
```

```
263 FORMAT(62H MISS DISTANCE ANALYSIS
   X RANGE)
    GO TO 269
261 PRINT 264
264 FORMAT(62H RANGE ERROR ANALYSIS
   X RANGE)
    GO TO 269
262 PRINT 265
265 FORMAT(62H AZIMUTH ERROR ANALYSIS
   X RANGE)
269 PRINT 270,(RAMID(I),I=1,II)
270 FORMAT( 9H AZIMUTH   F6.1,17F6.1)
    DO 285 I=1,JJ
    DO 271 J=1,II
    AMDIST(J)=DIST(I,J)/XOBSVN(I,J)
    DIST1= DIST(I,J)**2
    DIST2= XOBSVN(I,J)*DISTSQ(I,J)
    XOBS11=XOBSVN(I,J)*(XOBSVN(I,J)-1.)
    VARNCE(J)=(DIST2-DIST1)/XOBS11
    STADEV(J)=SQRTF(VARNCE(J))
    IF(SENSE SWITCH 3)271,289
289 PUNCH 272,CASE2,AZMID(I),RAMID(J),XOBSVN(I,J),AMDIST(J),STADEV(J),
   X VARNCE(J),DIST1,DIST2
271 CONTINUE
272 FORMAT(F5.0,F6.3,F7.1,F6.0,3F7.3,2F10.2)
    AZMID(I)=AZMID(I)/.0174533
    PRINT 273,((XOBSVN(I,J)),J=1,II)
273 FORMAT(F13.0,17F6.0)
    IF(K1)274,274,278
274 PRINT 275,AZMID(I),(AMDIST(J),J=1,II)
275 FORMAT(F6.1,F10.3,17F6.3)
    PRINT 276,(STADEV(J),J=1,II)
276 FORMAT(F16.3,17F6.3)
    GO TO 285
278 PRINT 279,AZMID(I),(AMDIST(J),J=1,II)
279 FORMAT(F7.1,F10.4,17F6.4)
280 PRINT 281,(STADEV(J),J=1,II)
281 FORMAT(F16.4,17F6.4)
285 CONTINUE
    GO TO 5
    END(0,1,0,0,1)
```

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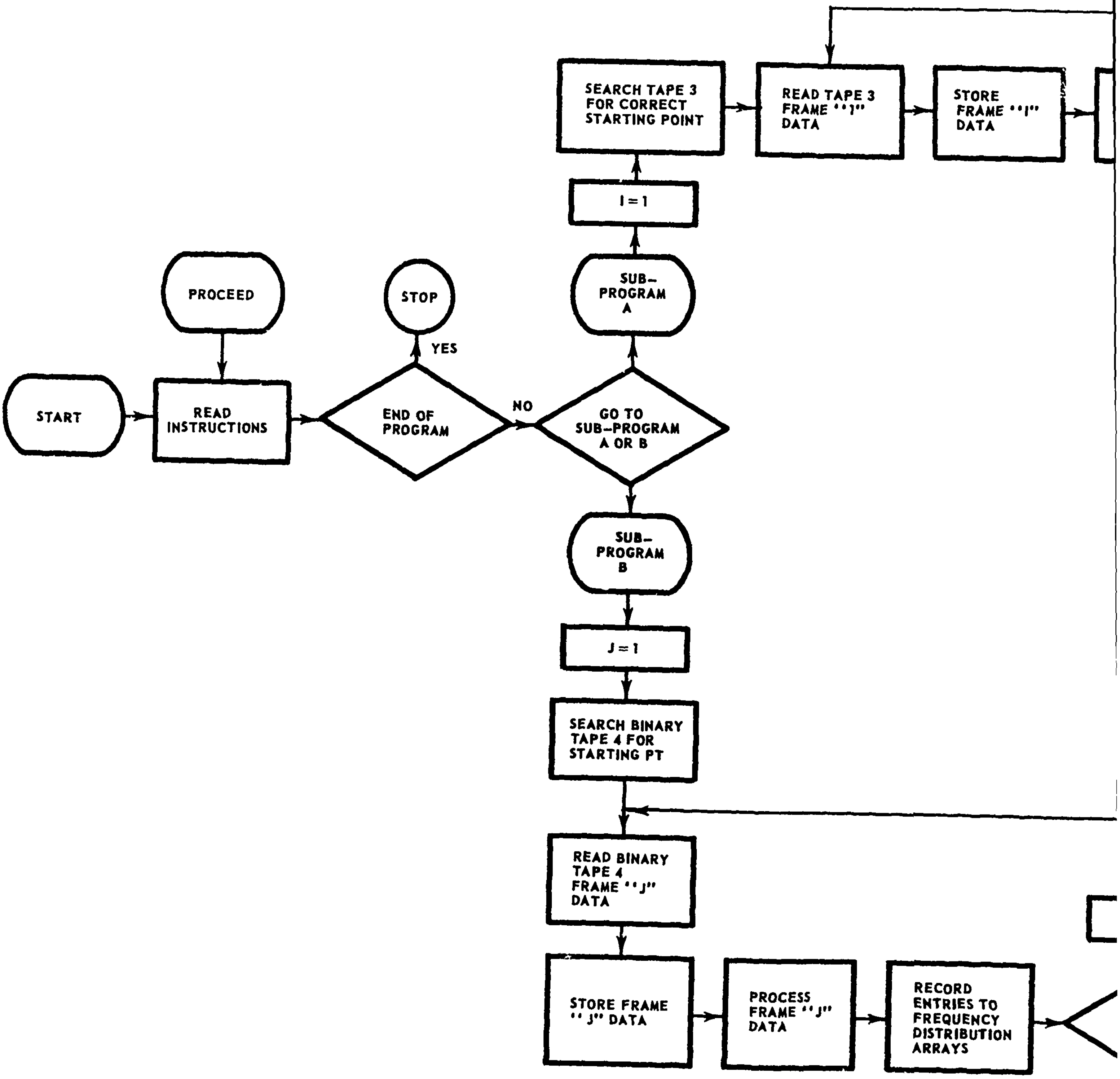

START
READ INSTRUCTIONS
PROCEED
END OF PROGRAM
YES
STOP
NO
GO TO SUB-PROGRAM A OR B
SUB-PROGRAM A
I = 1
SEARCH TAPE 3 FOR CORRECT STARTING POINT
READ TAPE 3 FRAME "I" DATA
STORE FRAME "I" DATA
SUB-PROGRAM B
J = 1
SEARCH BINARY TAPE 4 FOR STARTING PT
READ BINARY TAPE 4 FRAME "J" DATA
STORE FRAME "J" DATA
PROCESS FRAME "J" DATA
RECORD ENTRIES TO FREQUENCY DISTRIBUTION ARRAYS

A.

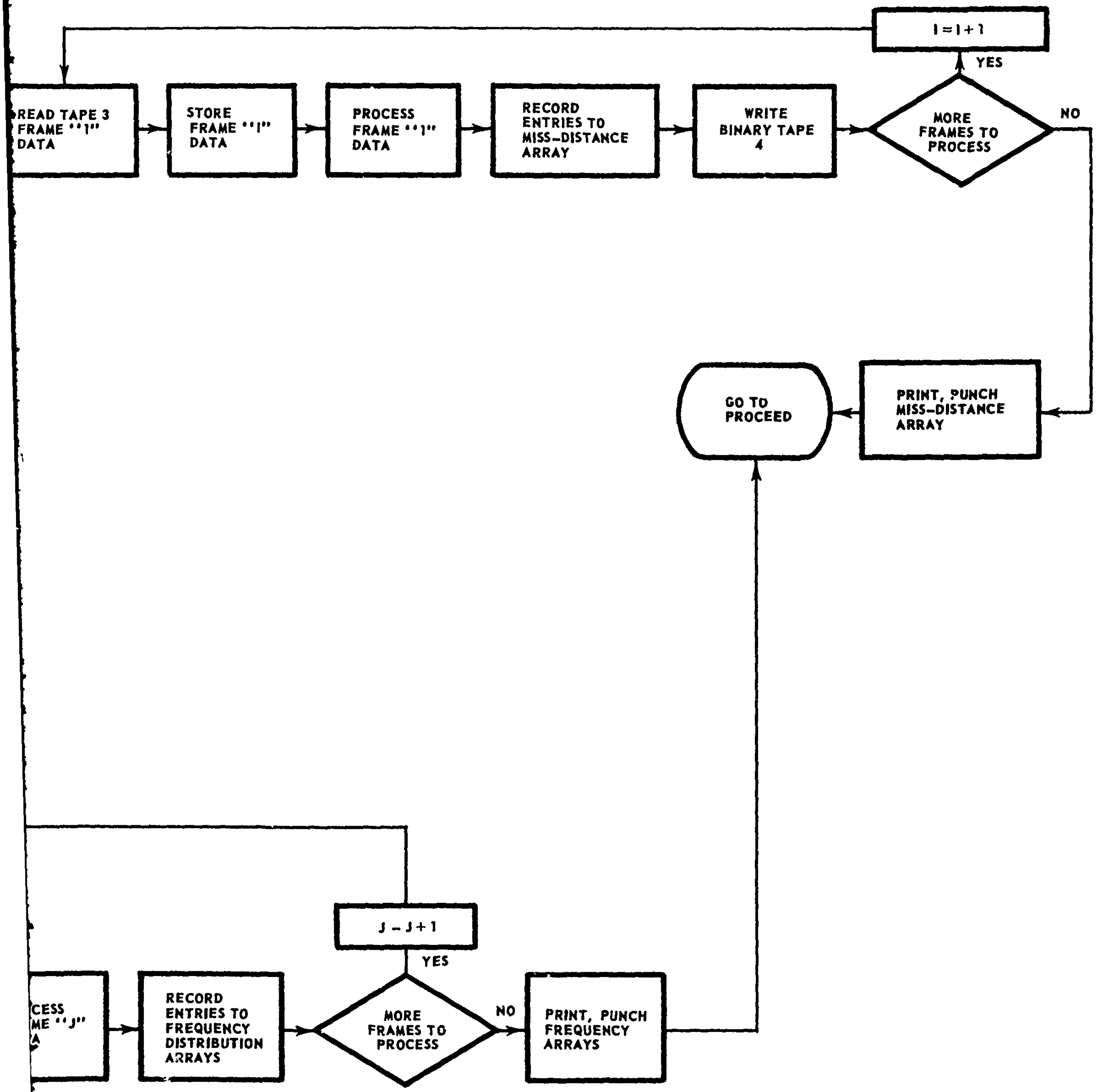
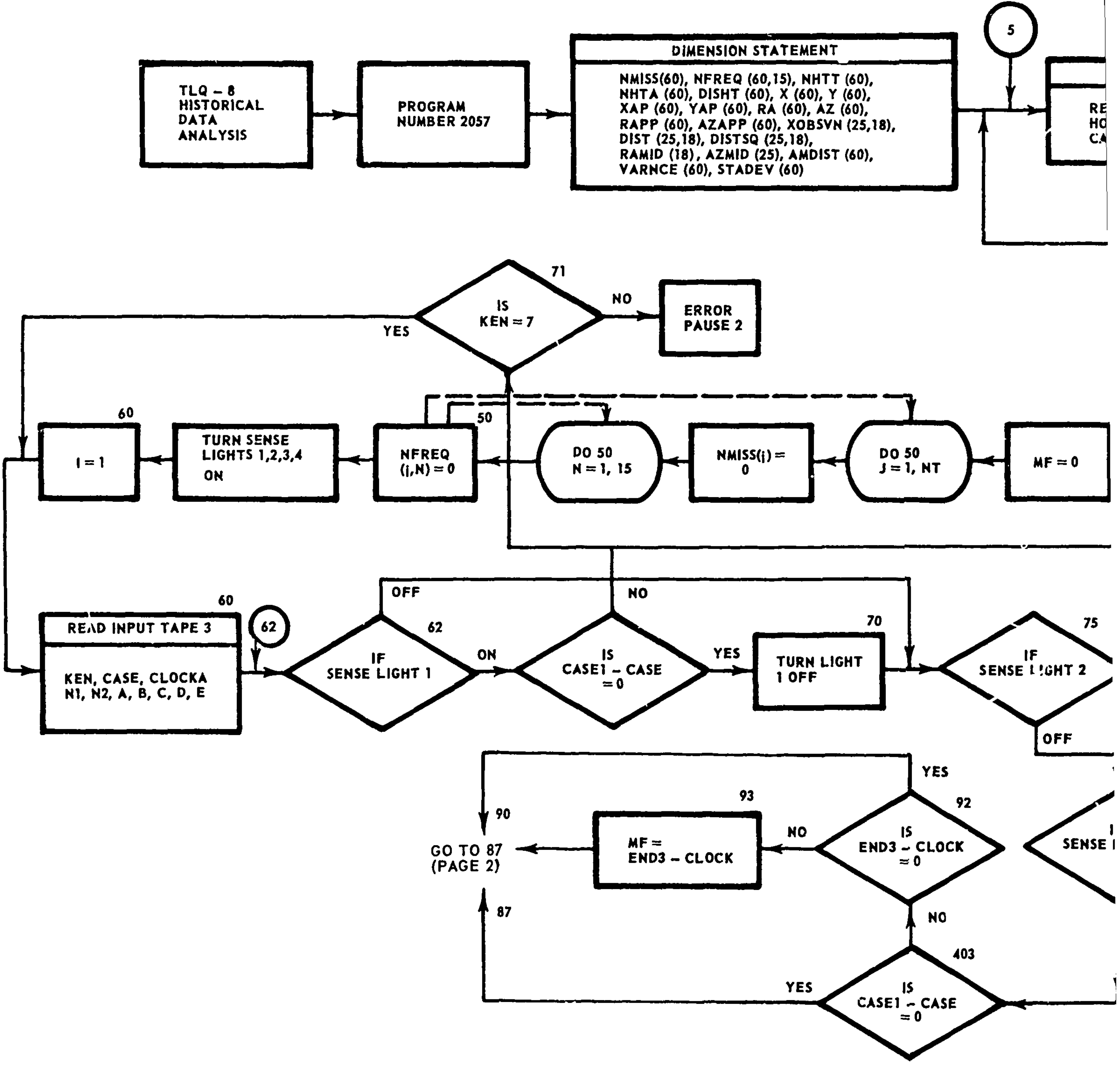

I = I + 1
YES
READ TAPE 3 FRAME "I" DATA
STORE FRAME "I" DATA
PROCESS FRAME "I" DATA
RECORD ENTRIES TO MISS-DISTANCE ARRAY
WRITE BINARY TAPE 4
MORE FRAMES TO PROCESS
NO
GO TO PROCEED
PRINT, PUNCH MISS-DISTANCE ARRAY
J - J + 1
YES
CESS ME "J" A
RECORD ENTRIES TO FREQUENCY DISTRIBUTION ARRAYS
MORE FRAMES TO PROCESS
NO
PRINT, PUNCH FREQUENCY ARRAYS

Figure 2-6 General Flow Charts

B.


TLQ – 8 HISTORICAL DATA ANALYSIS
PROGRAM NUMBER 2057
DIMENSION STATEMENT
NMISS(60), NFREQ (60,15), NHTT (60), NHTA (60), DISHT (60), X (60), Y (60), XAP (60), YAP (60), RA (60), AZ (60), RAPP (60), AZAPP (60), XOBSVN (25,18), DIST (25,18), DISTSQ (25,18), RAMID (18), AZMID (25), AMDIST (60), VARNCE (60), STADEV (60)
5
RE
HO
CA
71
IS KEN = 7
NO
ERROR PAUSE 2
YES
60
I = 1
TURN SENSE LIGHTS 1,2,3,4 ON
50
NFREQ (j,N) = 0
DO 50 N = 1, 15
NMISS(j) = 0
DO 50 J = 1, NT
MF = 0
60
READ INPUT TAPE 3
KEN, CASE, CLOCKA N1, N2, A, B, C, D, E
62
OFF
62
IF SENSE LIGHT 1
ON
NO
IS CASE1 – CASE = 0
YES
70
TURN LIGHT 1 OFF
75
IF SENSE LIGHT 2
OFF
YES
93
92
90
GO TO 87 (PAGE 2)
MF = END3 – CLOCK
NO
IS END3 – CLOCK = 0
SENSE
87
NO
403
YES
IS CASE1 – CASE = 0

A1

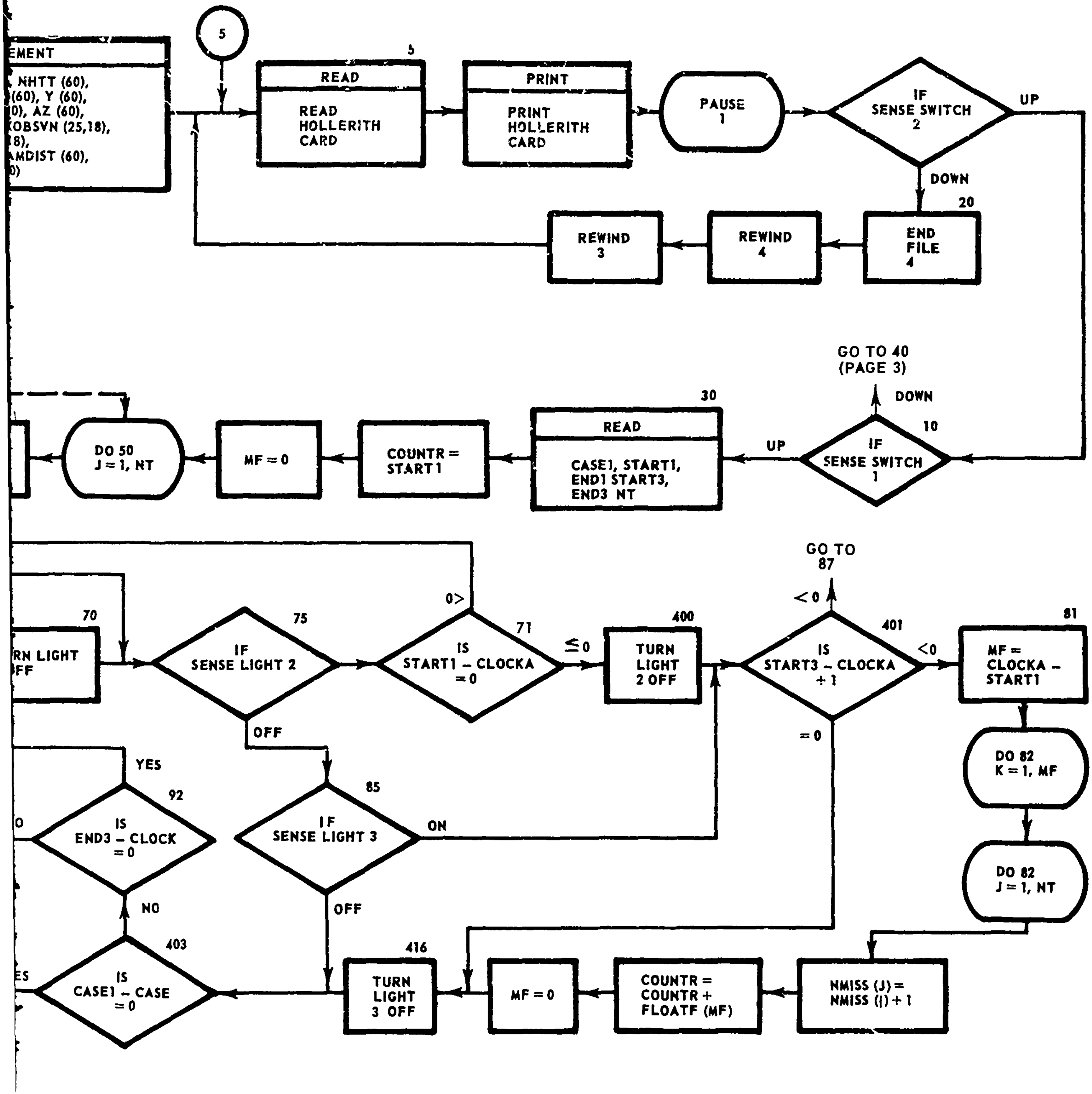
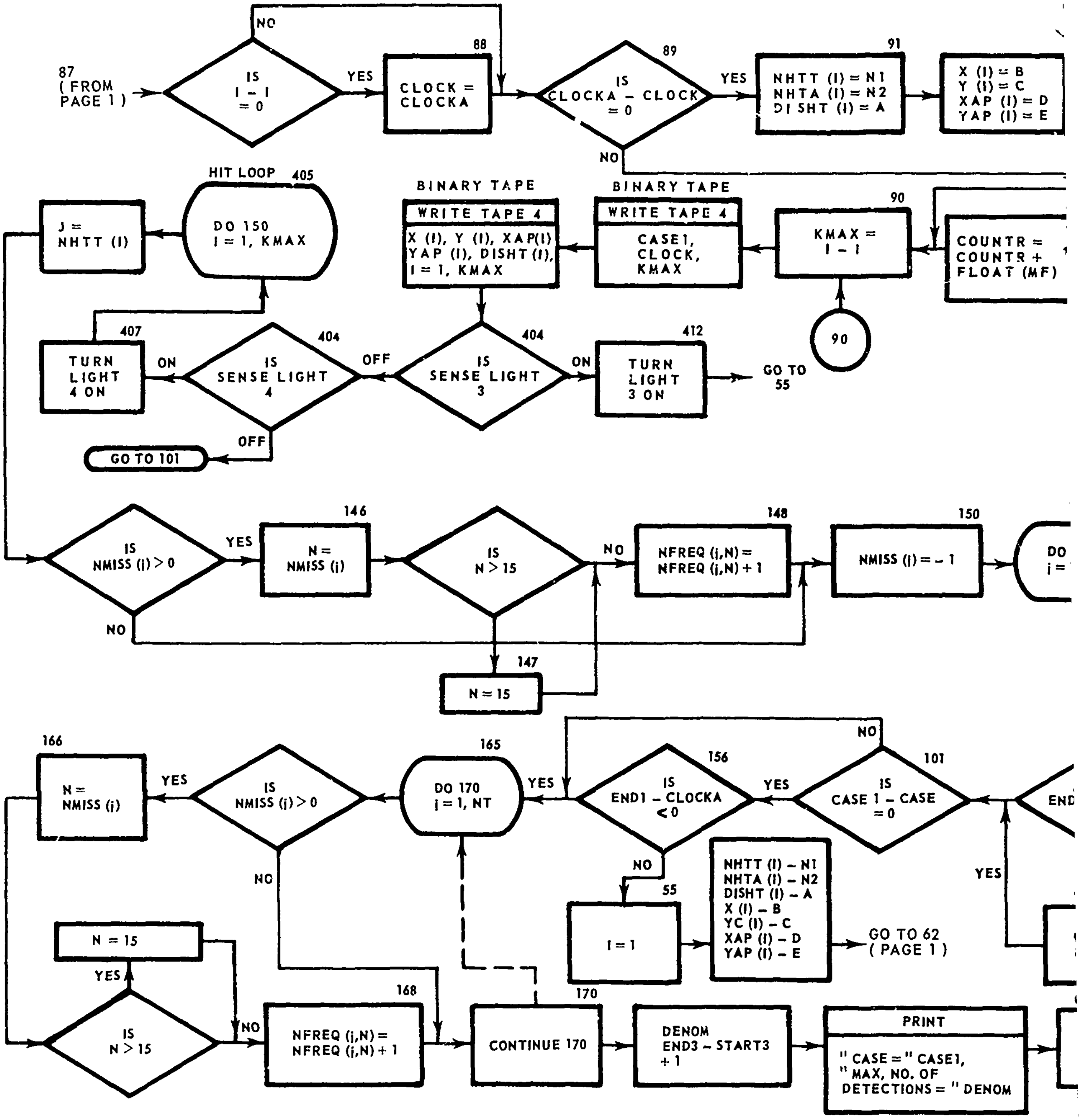


Figure 2-7 Historical Data Analysis Flow Charting

B.


87
(FROM
PAGE 1)
IS
I - I
= 0
NO
YES
88
CLOCK =
CLOCKA
89
IS
CLOCKA - CLOCK
= 0
YES
NO
91
NHTT (I) = N1
NHTA (I) = N2
DI SHT (I) = A
X (I) = B
Y (I) = C
XAP (I) = D
YAP (I) = E
HIT LOOP
405
DO 150
I = 1, KMAX
J =
NHTT (I)
BINARY TAPE
WRITE TAPE 4
X (I), Y (I), XAP(I)
YAP (I), DISHT (I),
I = 1, KMAX
BINARY TAPE
WRITE TAPE 4
CASE1,
CLOCK,
KMAX
90
KMAX =
I - I
COUNTR =
COUNTR +
FLOAT (MF)
90
407
TURN
LIGHT
4 ON
ON
404
IS
SENSE LIGHT
4
OFF
404
IS
SENSE LIGHT
3
ON
412
TURN
LIGHT
3 ON
GO TO
55
OFF
GO TO 101
IS
NMISS (j) > 0
YES
NO
146
N =
NMISS (j)
IS
N > 15
NO
147
N = 15
148
NFREQ (j,N) =
NFREQ (j,N) + 1
150
NMISS (I) = - 1
DO
i =
166
N =
NMISS (j)
YES
IS
NMISS (j) > 0
NO
165
DO 170
j = 1, NT
YES
156
IS
END1 - CLOCKA
< 0
NO
55
I = 1
NHTT (I) - N1
NHTA (I) - N2
DISHT (I) - A
X (I) - B
YC (I) - C
XAP (I) - D
YAP (I) - E
GO TO 62
(PAGE 1)
NO
YES
101
IS
CASE 1 - CASE
= 0
END
YES
N = 15
YES
IS
N > 15
NO
168
NFREQ (j,N) =
NFREQ (j,N) + 1
170
CONTINUE 170
DENOM
END3 - START3
+ 1
PRINT
" CASE = " CASE1,
" MAX, NO. OF
DETECTIONS = " DENOM

A1

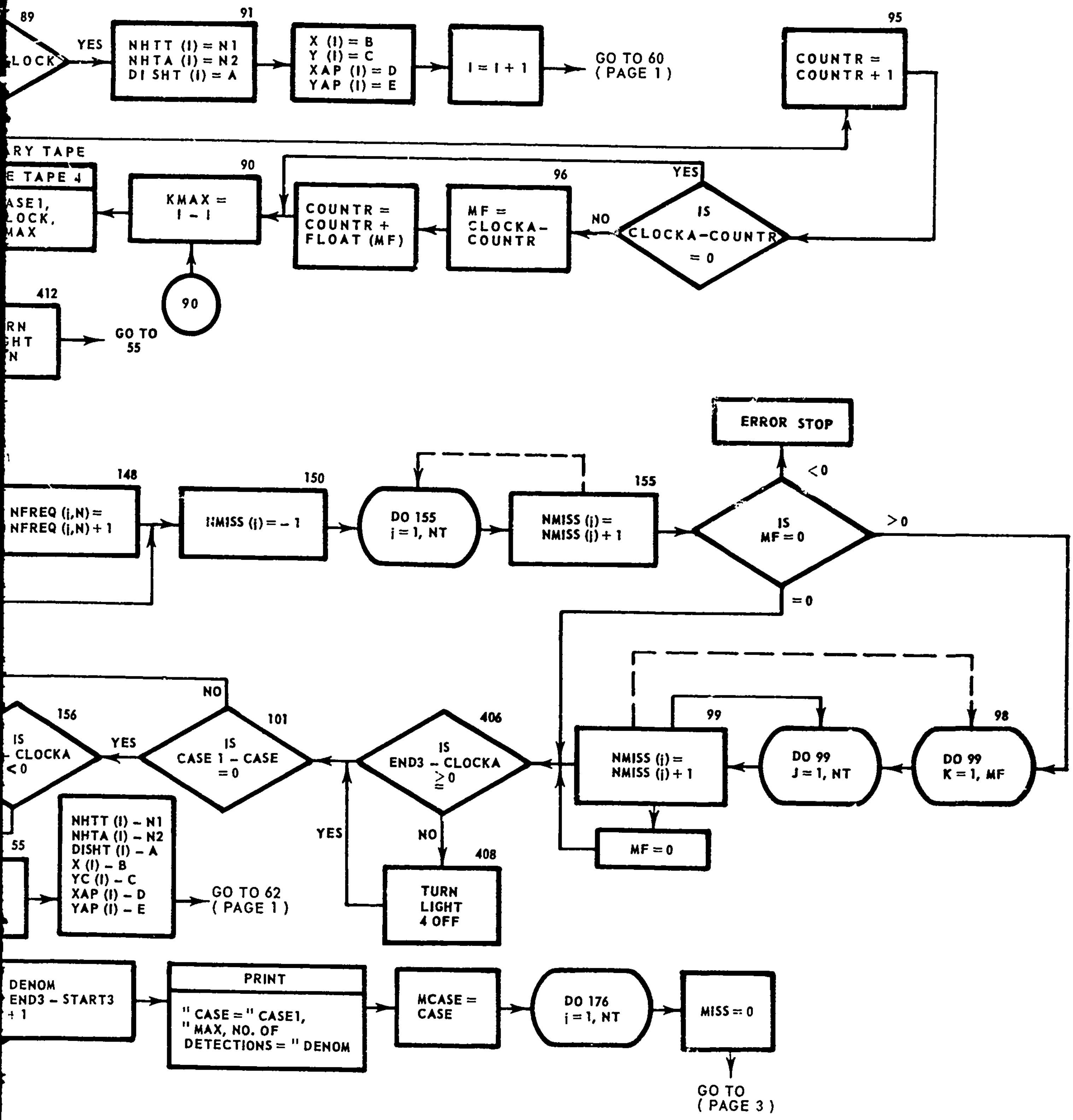
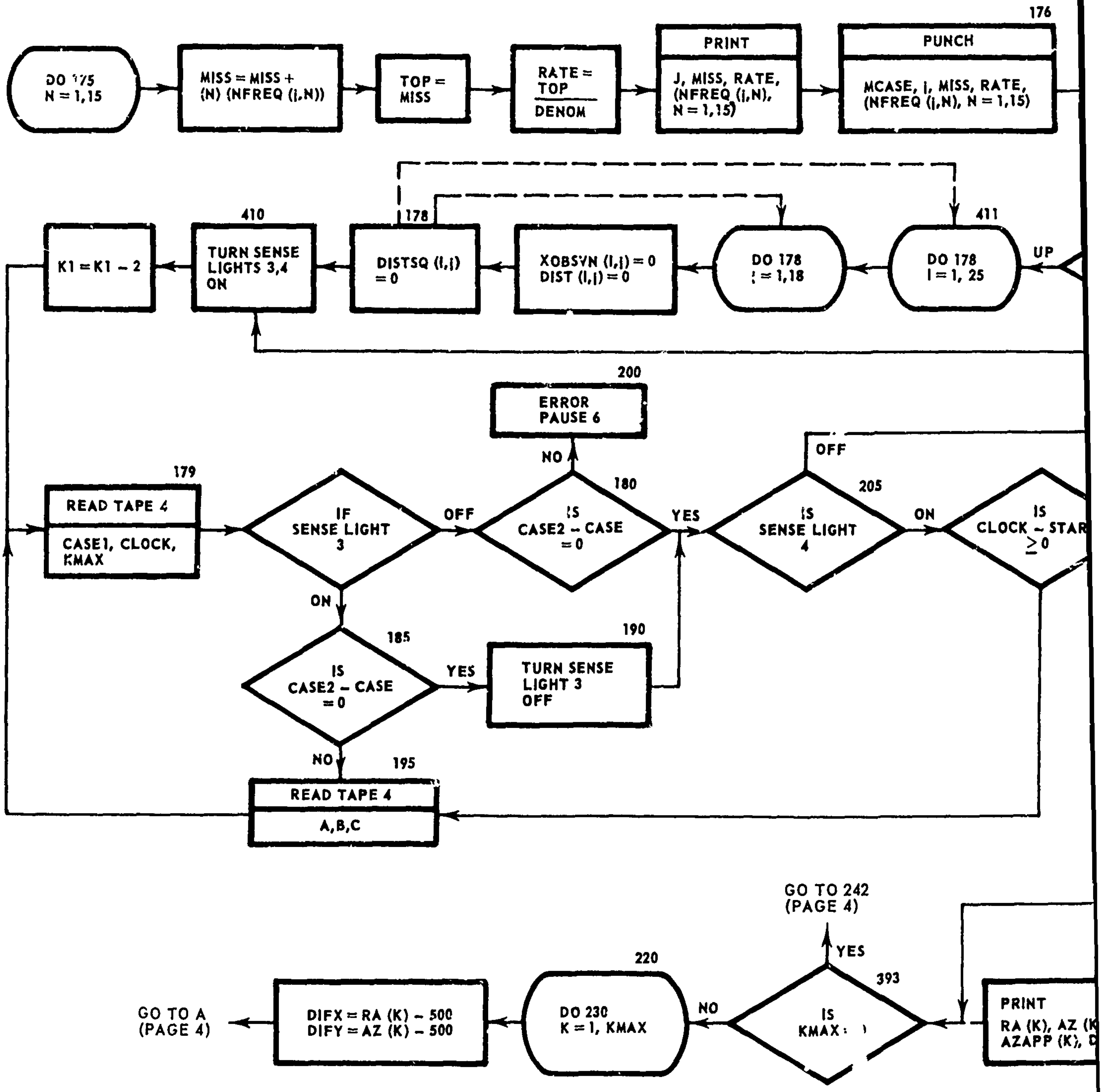


Figure 2-7 (Cont.)

B.

CONTINUED FROM PAGE 2



Fi

A,

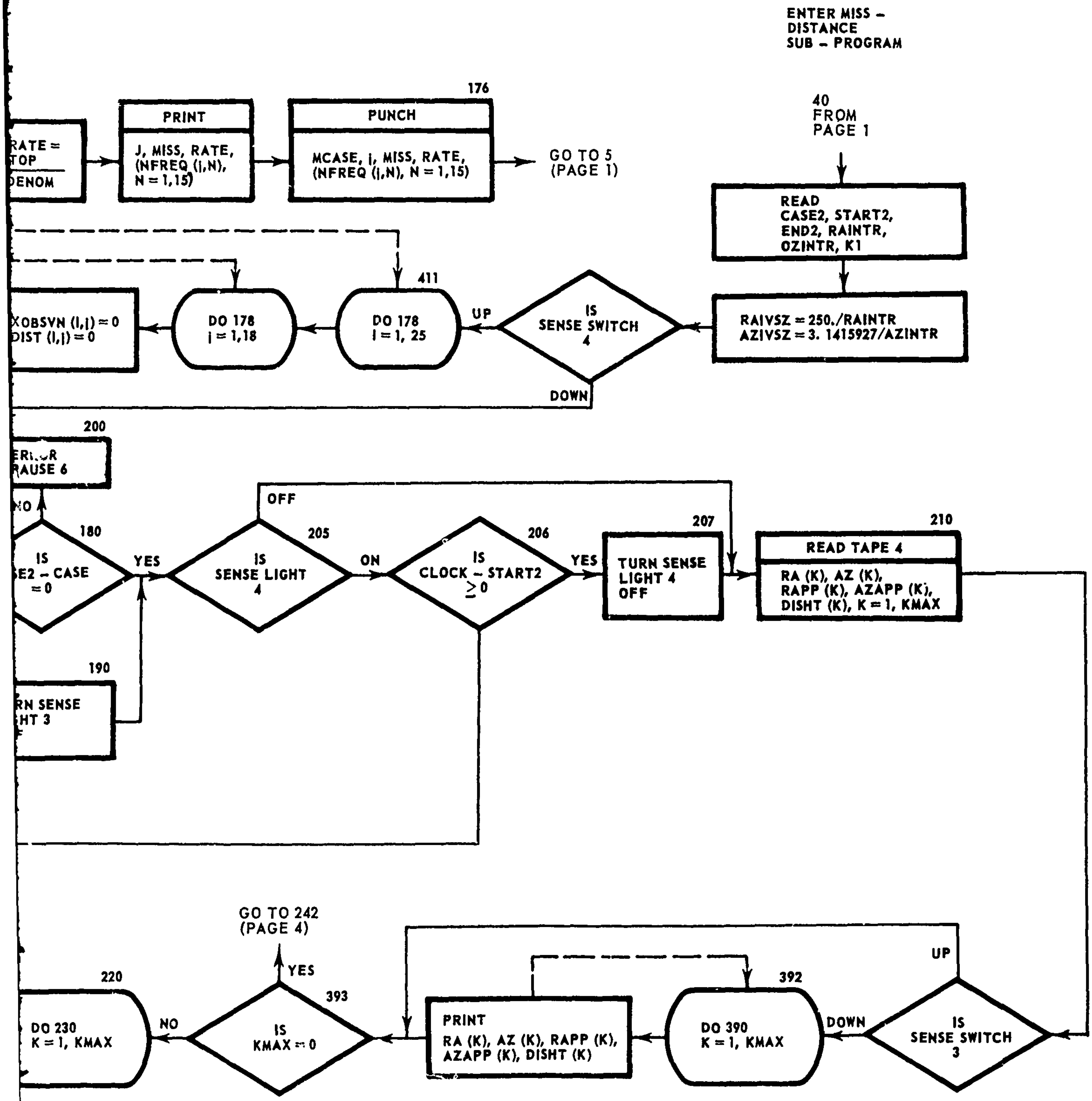


Figure 2-7 (Cont.)

B.

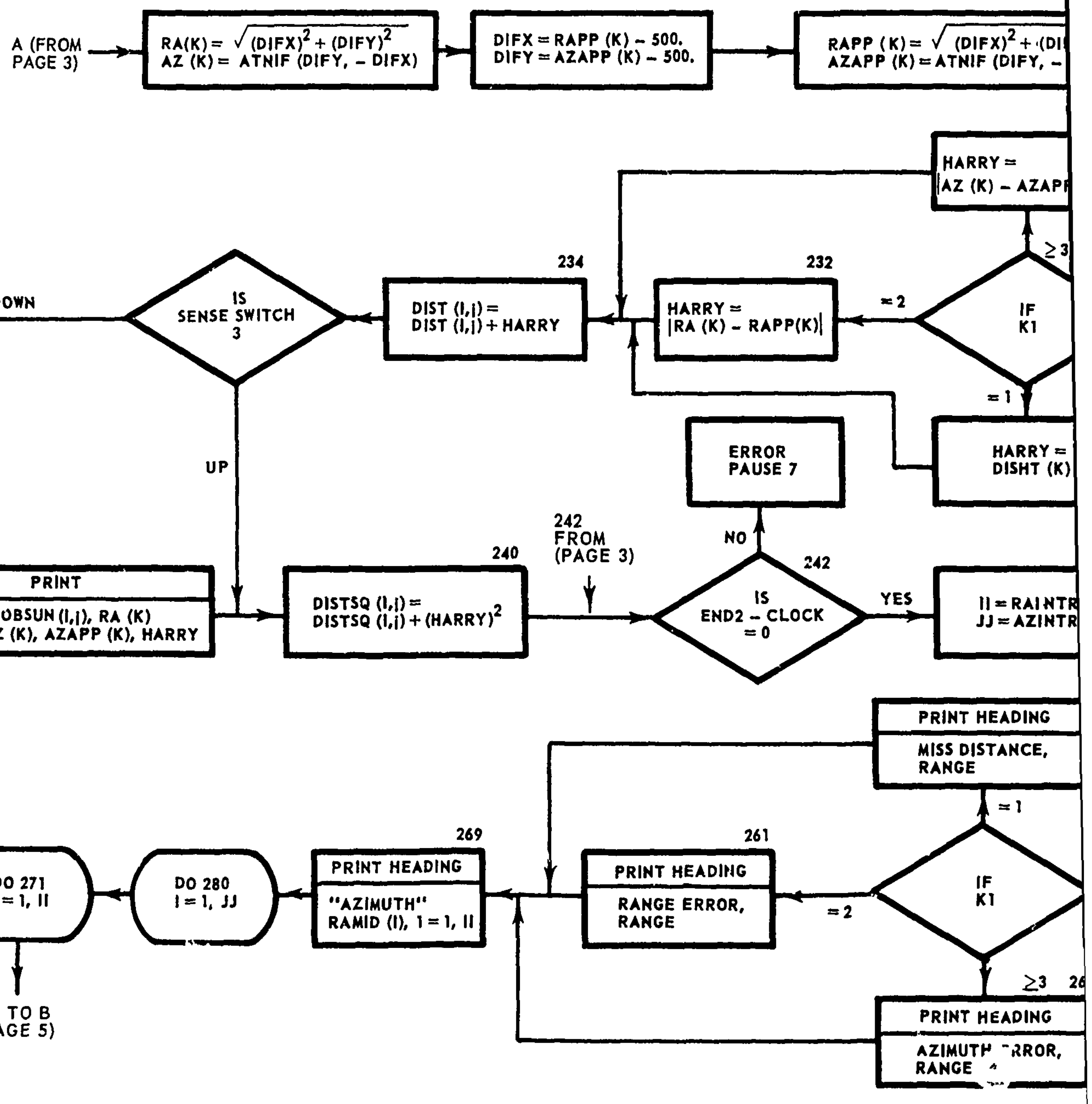

A (FROM PAGE 3)
RA(K) = $\sqrt{(DIFX)^2 + (DIFY)^2}$
AZ (K) = ATNIF (DIFY, - DIFX)
DIFX = RAPP (K) - 500.
DIFY = AZAPP (K) - 500.
RAPP (K) = $\sqrt{(DIFX)^2 + (DI}$
AZAPP (K) = ATNIF (DIFY, -
HARRY =
|AZ (K) - AZAPI
≥3
234
232
300 DOWN
IS SENSE SWITCH 3
DIST (I,J) = DIST (I,J) + HARRY
HARRY = |RA (K) - RAPP(K)|
= 2
IF K1
= 1
HARRY =
DISHT (K)
UP
ERROR PAUSE 7
242 FROM (PAGE 3)
NO
240
242
PRINT
KMAX, J, I, XOBSUN (I,J), RA (K) RAPP (K), AZ (K), AZAPP (K), HARRY
DISTSQ (I,J) = DISTSQ (I,J) + (HARRY)^2
IS END2 - CLOCK = 0
YES
II = RAINTR
JJ = AZINTR
PRINT HEADING
MISS DISTANCE, RANGE
= 1
269
261
DO 271 I = 1, II
DO 280 I = 1, JJ
PRINT HEADING
"AZIMUTH" RAMID (I), 1 = 1, II
PRINT HEADING
RANGE ERROR, RANGE
= 2
IF K1
GO TO B (PAGE 5)
≥3
26
PRINT HEADING
AZIMUTH ERROR, RANGE

Figure 2-

A.

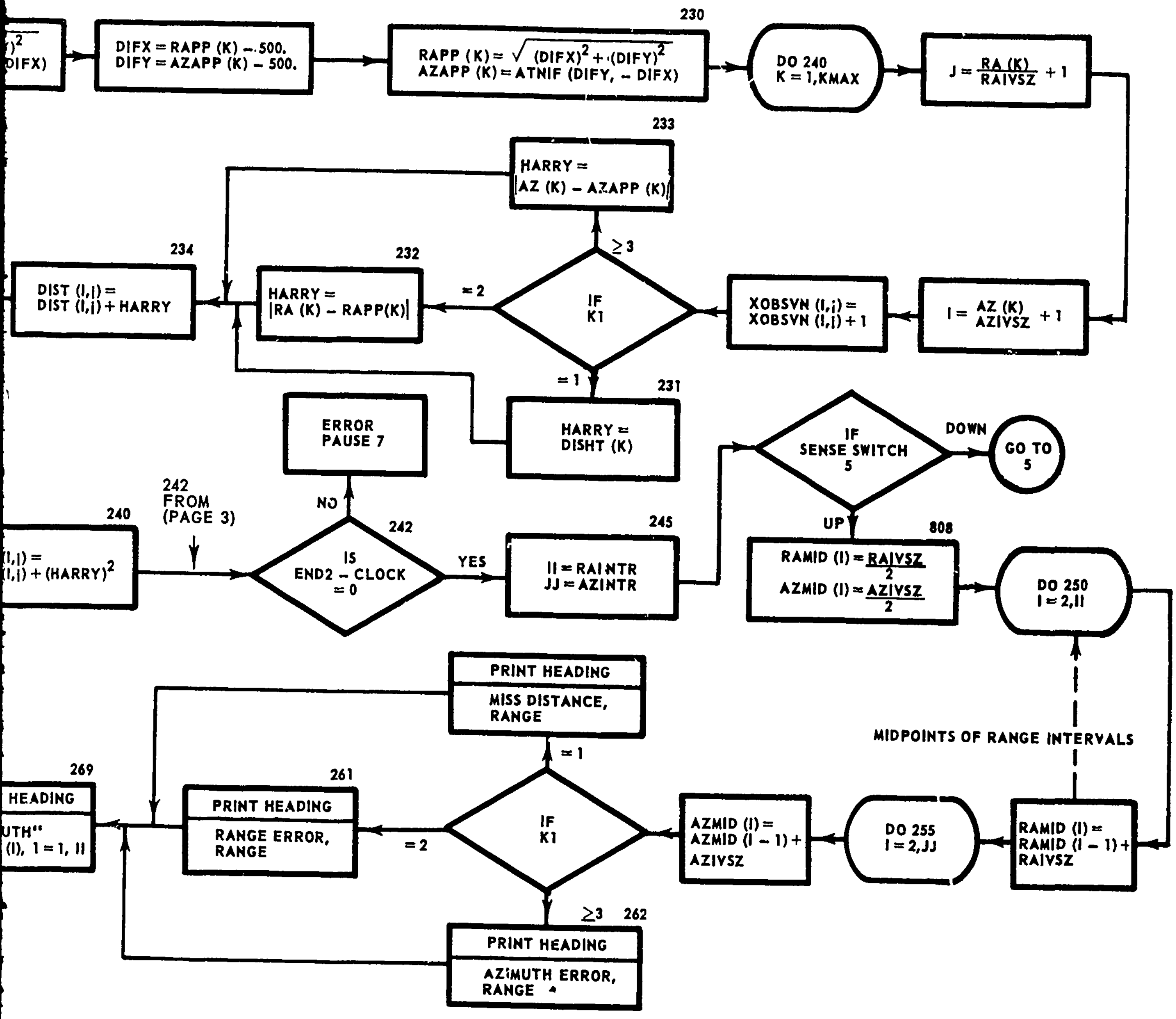


Figure 2-7 (Cont.)

B.

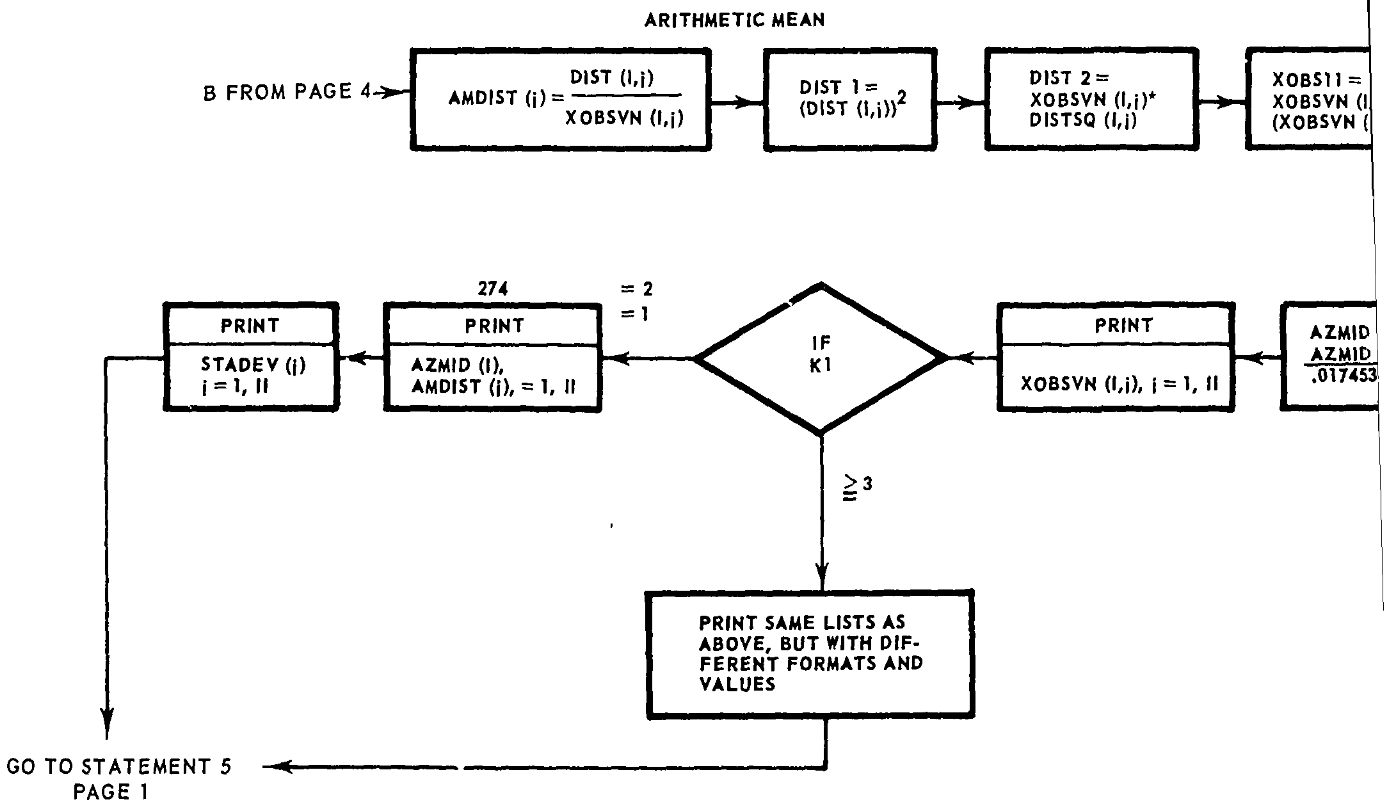
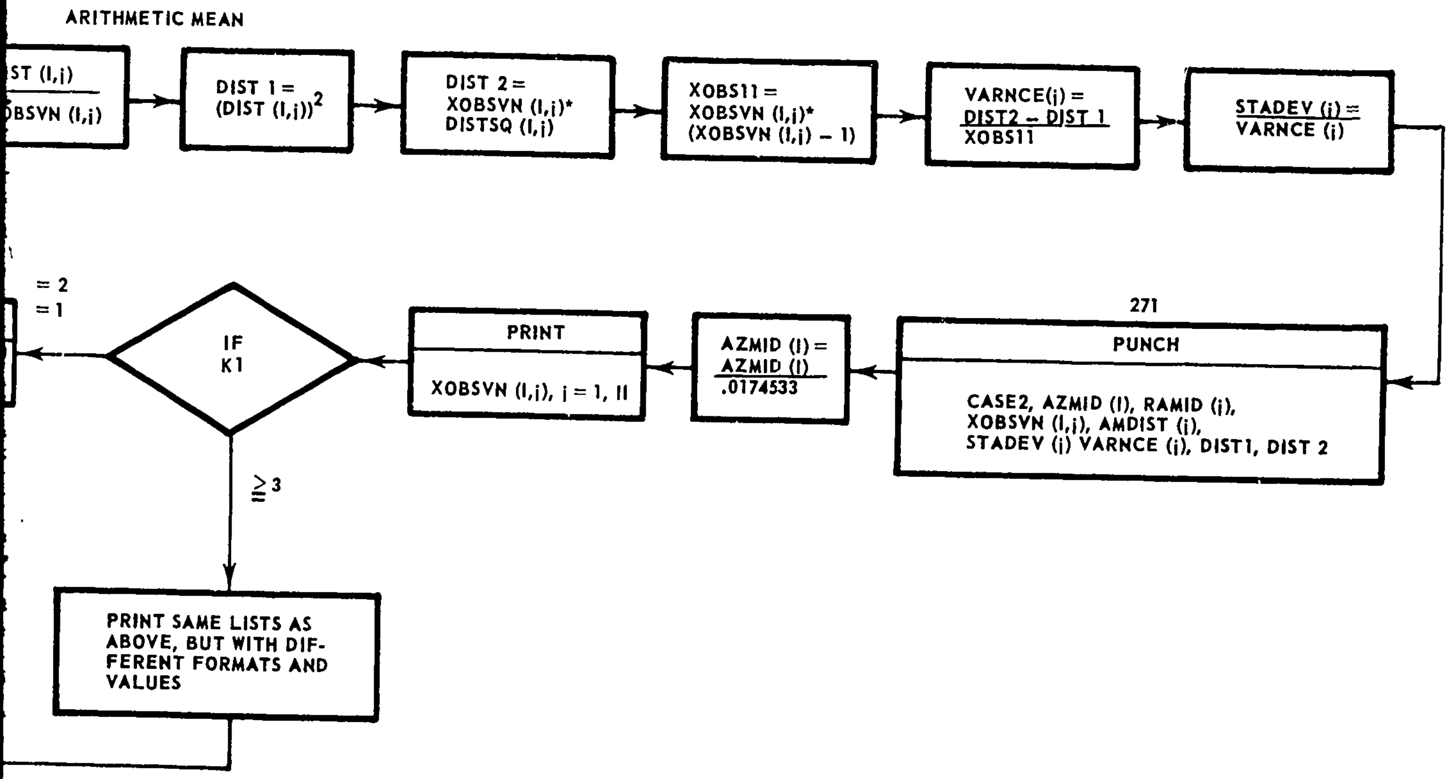

ARITHMETIC MEAN
B FROM PAGE 4
AMDIST (j) = DIST (I,j) / XOBSVN (I,j)
DIST 1 = (DIST (I,j))^2
DIST 2 = XOBSVN (I,j)* DISTSQ (I,j)
XOBS11 = XOBSVN (I (XOBSVN (
AZMID AZMID .017453
PRINT
XOBSVN (I,j), j = 1, II
IF K1
= 2
= 1
≧ 3
274
PRINT
AZMID (I), AMDIST (j), = 1, II
PRINT
STADEV (j) j = 1, II
PRINT SAME LISTS AS ABOVE, BUT WITH DIFFERENT FORMATS AND VALUES
GO TO STATEMENT 5 PAGE 1

Figure 2-7

A.



ARITHMETIC MEAN
ST (I,j)
OBSVN (I,j)
DIST 1 = (DIST (I,j))^2
DIST 2 = XOBSVN (I,j)* DISTSQ (I,j)
XOBS11 = XOBSVN (I,j)* (XOBSVN (I,j) – 1)
VARNCE(j) = DIST2 – DIST 1 / XOBS11
STADEV (j) = VARNCE (j)
271
PUNCH
CASE2, AZMID (I), RAMID (j), XOBSVN (I,j), AMDIST (j), STADEV (j) VARNCE (j), DIST1, DIST 2
AZMID (I) = AZMID (I) / .0174533
PRINT
XOBSVN (I,j), j = 1, II
IF K1
= 2
= 1
≧ 3
PRINT SAME LISTS AS ABOVE, BUT WITH DIFFERENT FORMATS AND VALUES

Figure 2-7 (Cont.)

B.